NXP BLF8G09LS-400PW 8G09LS-400PGW transistor datasheet

400 W LDMOS power transistor for base station applications at frequencies from 716 MHz to 960 MHz.

BLF8G09LS-400PW; BLF8G09LS-400PGW

Power LDMOS transistor

Rev. 3 — 24 March 2014 | Product data sheet

1. Product profile

1.1 General description

400 W LDMOS power transistor for base station applications at frequencies from 716 MHz to 960 MHz.

Table 1. Typical performance

Typical RF performance at T_{case} = 25 °C in a common source class-AB production test circuit, tested on straight lead device.

Test signal	f	I_{Dq}	V_{DS}	$P_{L(AV)}$	G_p	η_D	$ACPR_{5M}$
	(MHz)	(mA)	(V)	(W)	(dB)	(%)	(dBc)
2-carrier W-CDMA	716 to 728	3400	28	95	20.6	30	−35 [1]

[1] 3GPP test model 1; 64 DPCH; PAR = 8.4 dB at 0.01 % probability on CCDF; 10 MHz carrier spacing.

1.2 Features and benefits

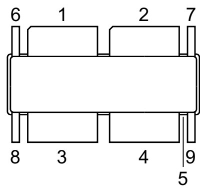
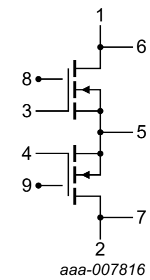
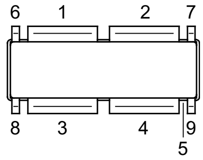
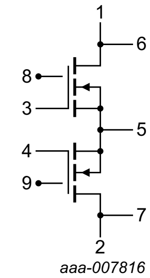
- Excellent ruggedness
- Device can operate with the supply current delivered through the video leads
- High efficiency
- Low thermal resistance providing excellent thermal stability
- Designed for broadband operation
- Lower output capacitance for improved performance in Doherty applications
- Decoupling leads to enable improved video bandwidth (45 MHz typical)
- Designed for low memory effects providing excellent pre-distortability
- Internally matched for ease of use
- Integrated ESD protection
- Design optimized for gull-wing
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- RF power amplifiers for base stations and multi carrier applications in the 716 MHz to 960 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLF8G09LS-400PW (SOT1242B)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		
6	decoupling1 [2]		
7	decoupling2 [2]		
8	n.c.		
9	n.c.		
BLF8G09LS-400PGW (SOT1242C)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		
6	decoupling1 [2]		
7	decoupling2 [2]		
8	n.c.		
9	n.c.		

[1] Connected to flange.

[2] Device can operate with the supply current delivered through the combined decoupling leads.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	**Description**	**Version**
BLF8G09LS-400PW	-	earless flanged ceramic package; 8 leads	SOT1242B
BLF8G09LS-400PGW	-	earless flanged ceramic package; 8 leads	SOT1242C

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
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 on-line MTF calculator.

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_{case} = 80 °C; P_L = 95 W	0.26	K/W

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 = 3 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 300 mA	1.5	1.8	2.3	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 1700 mA	1.7	2	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	2.8	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V		55	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	280	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 15 A	-	26	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 12.25 A	-	0.06	-	Ω

Table 7. RF characteristics

Test signal: 2-carrier W-CDMA; PAR = 8.4 dB at 0.01 % probability on the CCDF; 3GPP test model 1; 1-64 DPCH; f_1 = 718.5 MHz; f_2 = 723.5 MHz; f_3 = 720.5 MHz; f_4 = 725.5 MHz; RF performance at V_{DS} = 28 V; I_{Dq} = 3400 mA; T_{case} = 25 °C; unless otherwise specified; in a class-AB production test circuit, tested on straight lead device.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	$P_{L(AV)}$ = 95 W	18.8	20.6	-	dB
RL_{in}	input return loss	$P_{L(AV)}$ = 95 W	-	–19	–11	dB
η_D	drain efficiency	$P_{L(AV)}$ = 95 W	26	30	-	%
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	$P_{L(AV)}$ = 95 W	-	–35	–32	dBc

7. Test information

7.1 Ruggedness in class-AB operation

The BLF8G09LS-400PW and BLF8G09LS-400PGW are capable of withstanding a load mismatch corresponding to VSWR = 7 : 1 through all phases under the following conditions: V_{DS} = 28 V; I_{Dq} = 3400 mA; 2-carrier W-CDMA signal; P_L = 200 W; f = 716 MHz; 5 MHz carrier spacing; 46 % clipping.

7.2 Impedance information

Table 8. Typical impedance

Measured load-pull data for the top-half of the push-pull package; I_{Dq} = 1800 mA; V_{DS} = 28 V; T_{case} = 25 °C, water cooled.

f	Z_S [1]	Z_L [1]
(MHz)	(Ω)	(Ω)
BLF8G09LS-400PW (straight lead)		
720	1.26 – j2.89	1.8 – j1.94
757	1.44 – j3.82	2 – j1.6
769	1.55 – j3.64	1.9 – j1.75
805	1.7 – j4.5	1.5 – j1.3
BLF8G09LS-400PGW (gull-wing)		
720	1.37 – j3	1.7 – j2.1
757	1.4 – j3.6	1.6 – j2.3
769	1.3 – j3.9	1.7 – j2.2
805	1.6 – j4.3	1.48 – j1.97

[1] Z_S and Z_L defined in Figure 1.

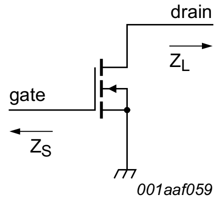
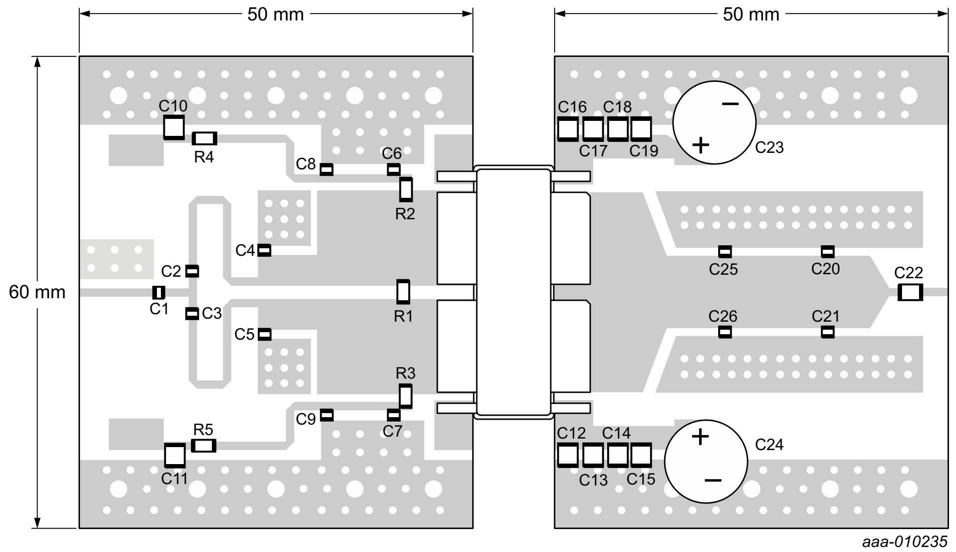


Fig 1. Definition of transistor impedance

7.3 VBW in class-AB operation

The BLF8G09LS-400PW and BLF8G09LS-400PGW show 45 MHz (typical) video bandwidth in class-AB test circuit in 722 MHz band at V_{DS} = 28 V and I_{Dq} = 3400 mA.

7.4 Test circuit



Printed-Circuit Board (PCB): Rogers RO4350B; ε_r = 3.66; thickness = 0.508 mm; thickness copper plating = 35 μm.

See Table 9 for a list of components.

Fig 2. Component layout

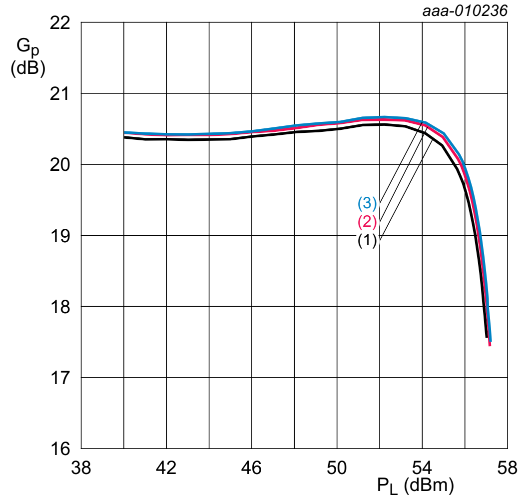
Table 9. List of components

For test circuit see Figure 2.

Component	Description	Value	Remarks
C1, C2, C3, C8, C9	multilayer ceramic chip capacitor	100 pF	ATC 100A
C4, C5	multilayer ceramic chip capacitor	9.1 pF	ATC 100A
C6, C7	multilayer ceramic chip capacitor	10 pF	ATC 100A
C10, C11, C13, C17	multilayer ceramic chip capacitor	1 μF, 50 V	Murata
C12, C16	multilayer ceramic chip capacitor	100 nF, 50 V	Murata
C14, C15, C18, C19	multilayer ceramic chip capacitor	10 μF, 50 V	Murata
C20, C21	multilayer ceramic chip capacitor	5.1 pF	ATC 100A
C22	multilayer ceramic chip capacitor	82 pF	ATC 100B
C23, C24	electrolytic capacitor	470 μF, 63 V	
C25, C26	multilayer ceramic chip capacitor	3 pF	ATC 100A
R1	resistor	10 Ω	
R2, R3, R4, R5	resistor	5.1 Ω	

7.5 Graphical data

7.5.1 Pulsed CW



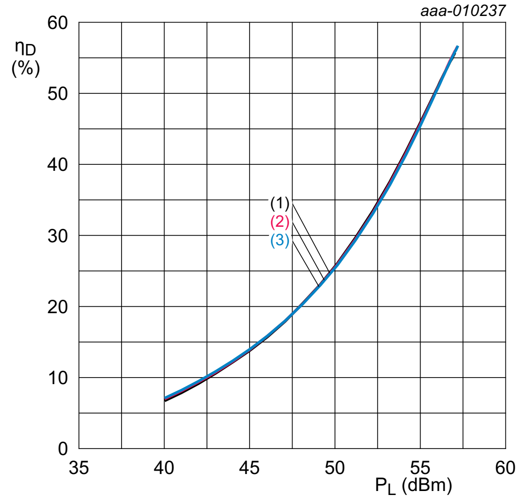
V_{DS} = 28 V; I_{Dq} = 3400 mA; t_p = 100 μs; δ = 10 %.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 3. Power gain as a function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 3400 mA; t_p = 100 μs; δ = 10 %.

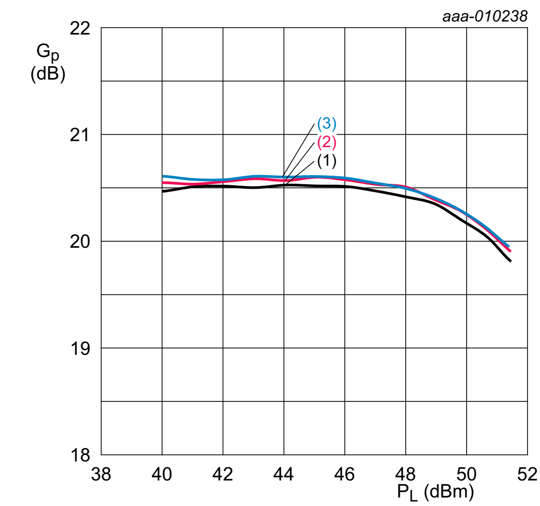
(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 4. Drain efficiency as a function of output power; typical values

7.5.2 IS-95



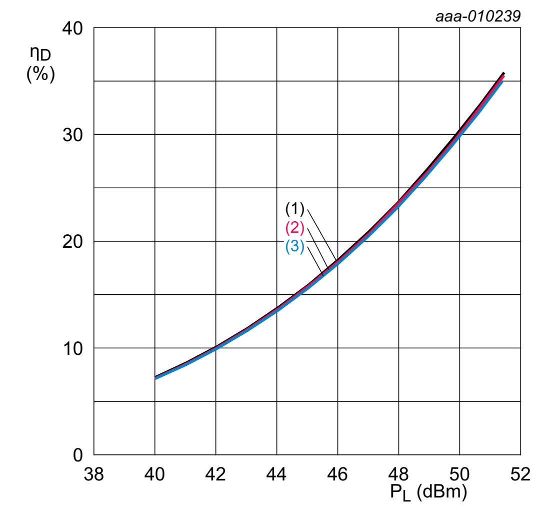
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 5. Power gain as a function of output power; typical values



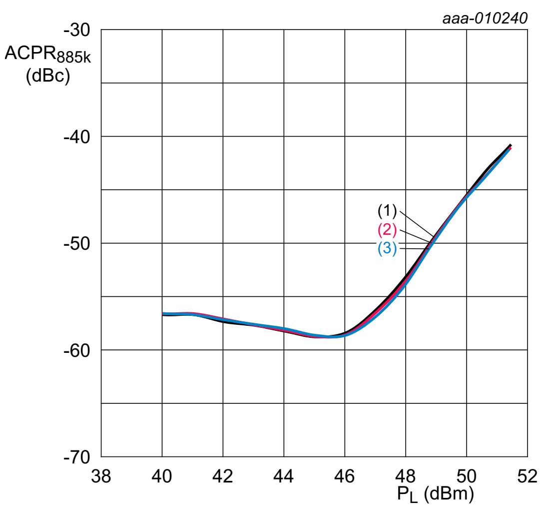
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 6. Drain efficiency as a function of output power; typical values



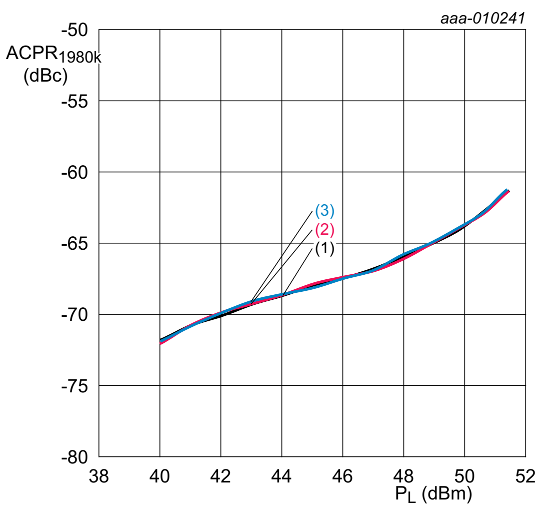
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 7. Adjacent channel power ratio (885 kHz) as a function of output power; typical values



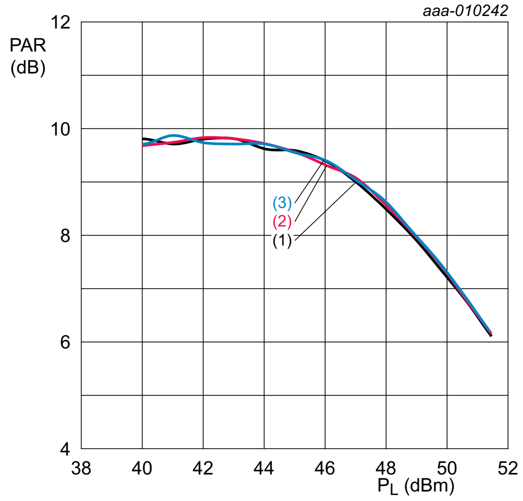
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 8. Adjacent channel power ratio (1980 kHz) as a function of output power; typical values



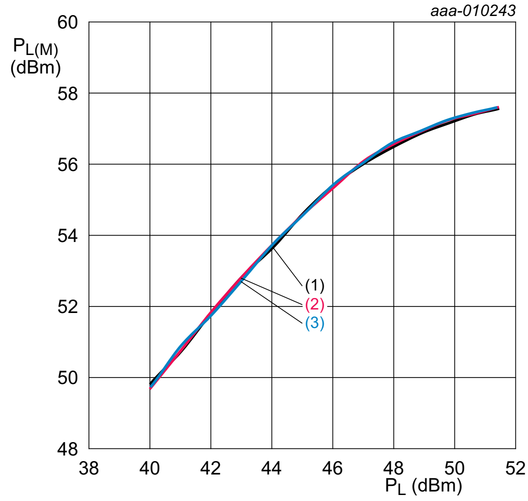
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 9. Peak-to-average ratio as a function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 3400 mA.

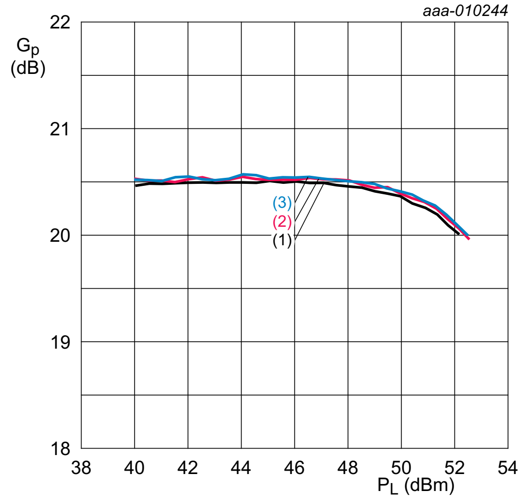
(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 10. Peak output power as a function of output; typical values

7.5.3 1-Carrier W-CDMA



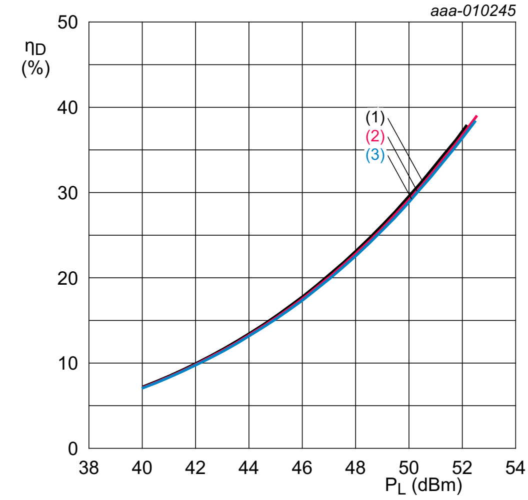
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 11. Power gain as a function of output power; typical values



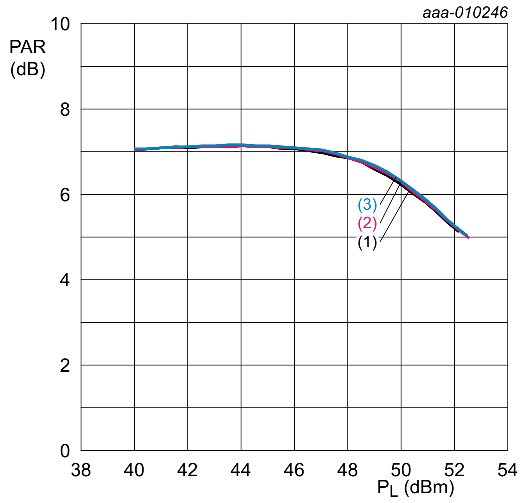
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 12. Drain efficiency as a function of output power; typical values



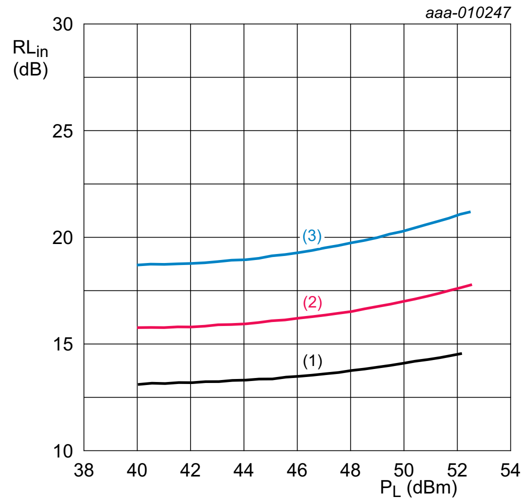
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 13. Peak-to-average ratio as a function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 3400 mA.

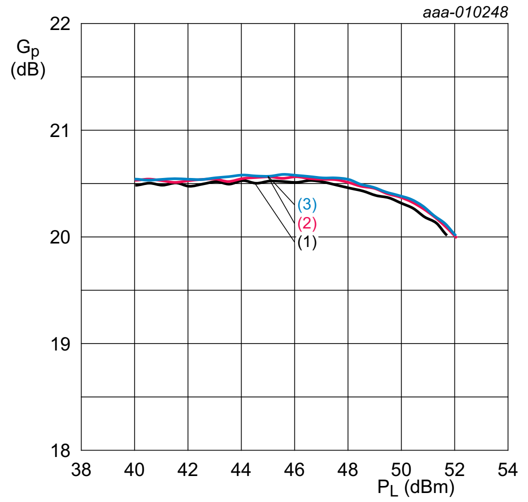
(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 14. Input return loss as a function of output power; typical values

7.5.4 2-Carrier W-CDMA



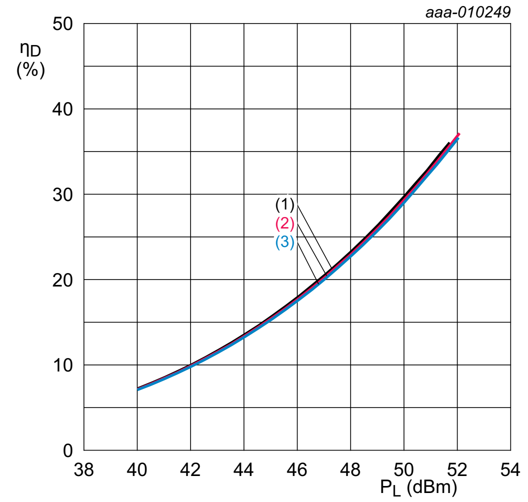
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 15. Power gain as a function of output power; typical values



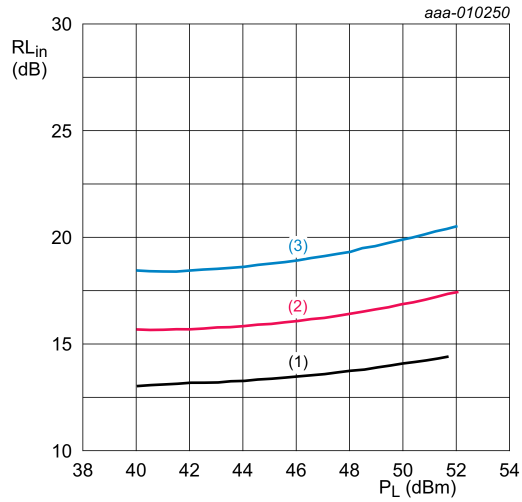
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 16. Drain efficiency as a function of output power; typical values



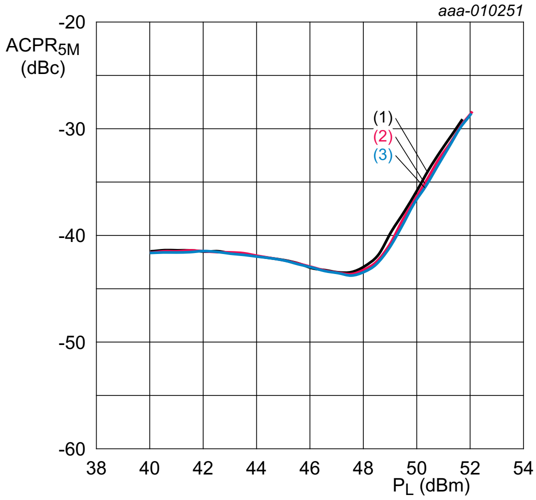
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 17. Input return loss as a function of output power; typical values



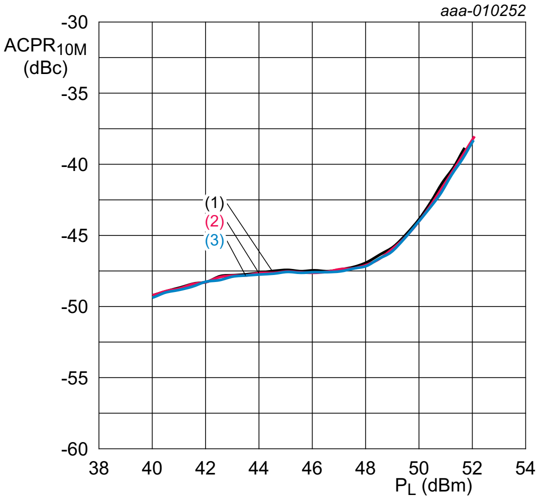
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 18. Adjacent channel power ratio (5 MHz) as a function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 3400 mA.

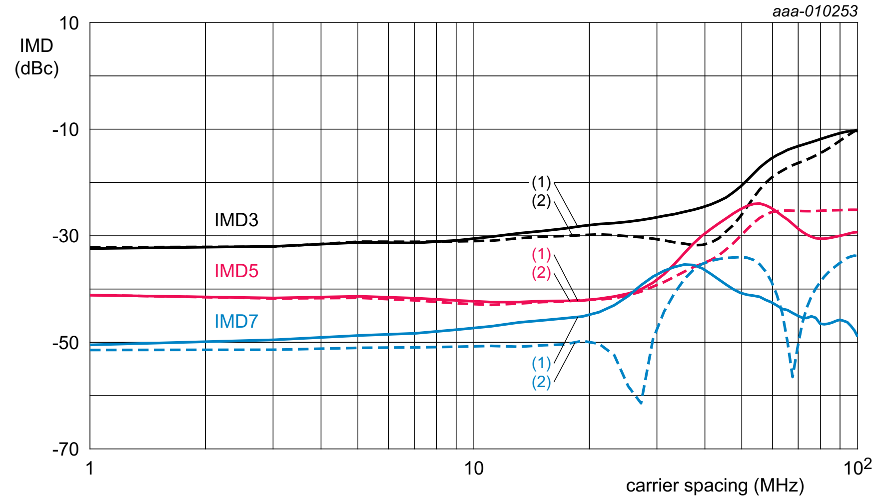
(1) f = 716 MHz

(2) f = 722 MHz

(3) f = 728 MHz

Fig 19. Adjacent channel power ratio (10 MHz) as a function of output power; typical values

7.5.5 2-Tone VBW



V_{DS} = 28 V; I_{Dq} = 3400 mA.

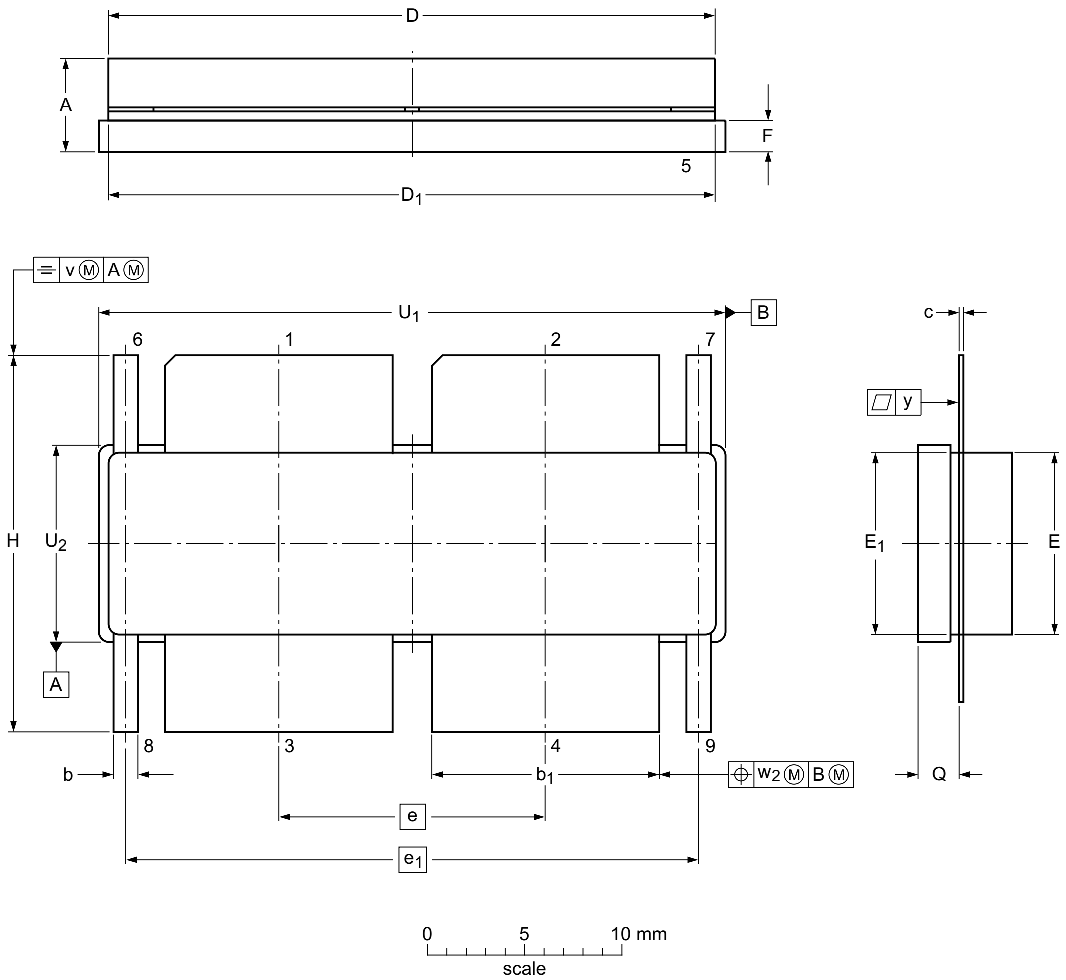
(1) IMD low

(2) IMD high

Fig 20. VBW capability in class-AB test circuit

8. Package outline

Earless flanged ceramic package; 8 leads **SOT1242B**



Dimensions

Unit(1)		A	b	b_1	c	D	D_1	e	e_1	E	E_1	F	H	Q(2)	U_1	U_2	v	w_2	y
mm	max	5.5	1.41	11.81	0.18	31.55	31.52			9.50	9.53	1.75	19.94	2.26	32.39	10.29	0.25	0.25	0.25
	nom							13.72	29.47										
	min	4.2	1.14	11.56	0.10	30.94	30.96			9.30	9.27	1.50	18.92	2.01	32.13	10.03			
inches	max	0.217	0.055	0.465	0.007	1.242	1.241			0.374	0.375	0.069	0.785	0.089	1.275	0.405	0.010	0.010	0.010
	nom							0.540	1.16										
	min	0.165	0.045	0.455	0.004	0.218	1.219			0.366	0.365	0.059	0.745	0.079	1.265	0.395			

Note

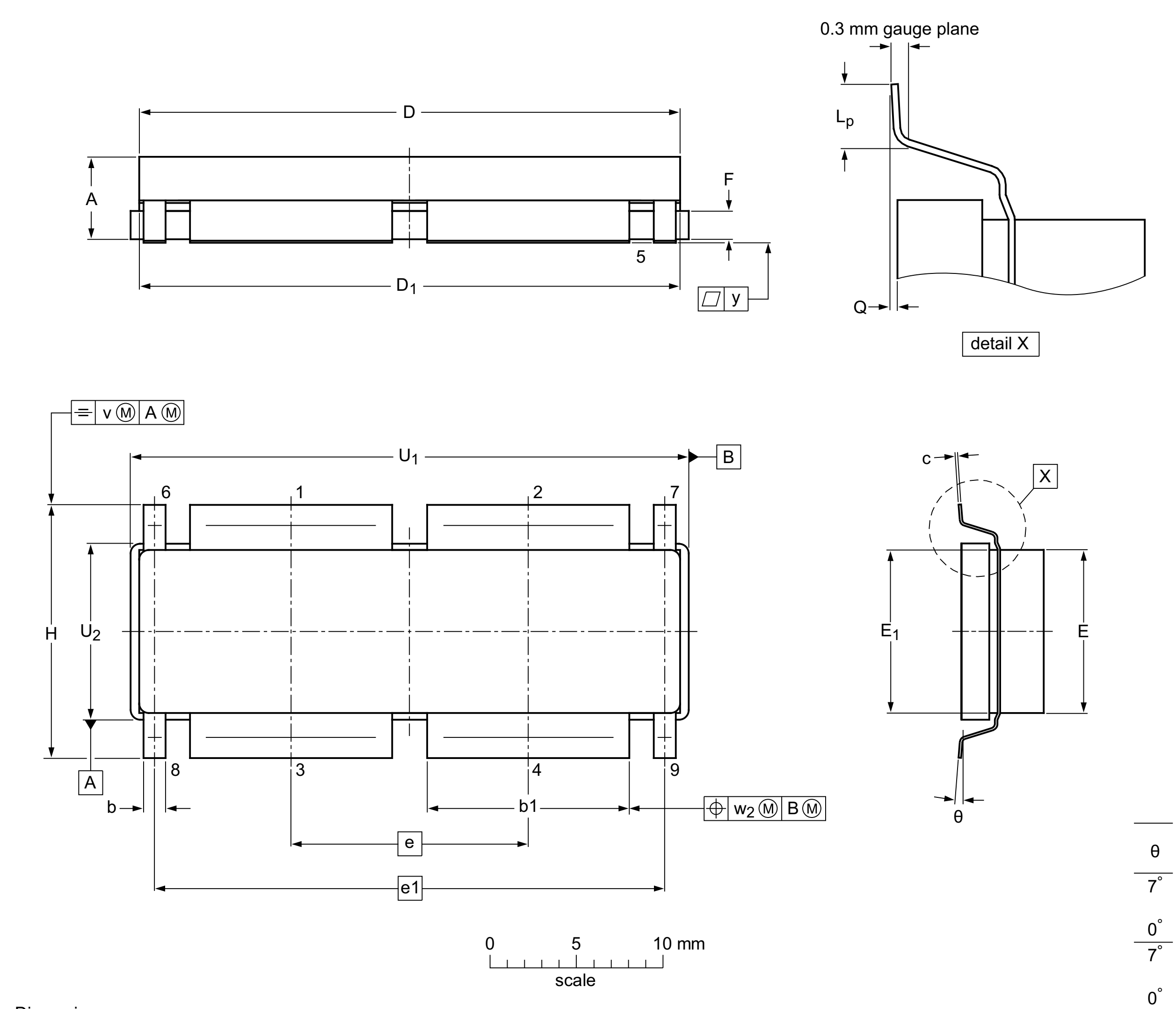
1. Millimeter dimensions are derived from the original inch dimensions.
2. Dimension is measured 0.030 inch (0.76 mm) from the body.

sot1242b_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1242B					(projection symbol)	~~12-05-08~~ 12-11-28

Fig 21. Package outline SOT1242B

Earless flanged ceramic package; 8 leads **SOT1242C**



Dimensions

Unit(1)		A	b	b1	c	D	D_1	e	e1	E	E_1	F	H	L_p	Q	U_1	U_2	v	w_2	y
mm	max	5.5	1.41	11.81	0.18	31.55	31.52			9.50	9.53	1.75	14.70	1.38	0.195	32.39	10.29	0.25	0.25	0.15
	nom							13.72	29.47											
	min	4.2	1.14	11.56	0.10	30.94	30.96			9.30	9.27	1.50	14.50	0.98	0.045	32.13	10.03			
inches	max	0.217	0.055	0.465	0.007	1.242	1.241			0.374	0.375	0.069	0.579	0.055	0.008	1.275	0.405	0.01	0.01	0.006
	nom							0.540	1.16											
	min	0.165	0.045	0.455	0.004	1.218	1.219			0.366	0.365	0.059	0.571	0.039	0.002	1.265	0.395			

Note

1. Millimeter dimensions are derived from the original inch dimensions.

sot1242c_po

Outline version	References IEC	References JEDEC	References JEITA		European projection	Issue date
SOT1242C						~~12-05-15~~ 12-05-30

Fig 22. Package outline SOT1242C

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.

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
3GPP	3rd Generation Partnership Project
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
DPCH	Dedicated Physical CHannel
ESD	ElectroStatic Discharge
IS-95	Interim Standard 95
LDMOS	Laterally Diffused Metal Oxide Semiconductor
MTF	Median Time to Failure
PAR	Peak-to-Average Ratio
VBW	Video Bandwidth
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

11. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF8G09LS-400PW_8G09LS-400PGW v.3	20140324	Product data sheet	-	BLF8G09LS-400PW_8G09LS-400PGW v.2
Modifications:	• Table 7 on page 3: min. value η_D changed from 27 to 26			
BLF8G09LS-400PW_8G09LS-400PGW v.2	20131220	Preliminary data sheet	-	BLF8G09LS-400PW_8G09LS-400PGW v.1
BLF8G09LS-400PW_8G09LS-400PGW v.1	20130927	Objective 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".

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