BLF8G20LS-400PV; BLF8G20LS-400PGV

Power LDMOS transistor

Rev. 4 — 28 July 2015 | Product data sheet

1. Product profile

1.1 General description

400 W LDMOS power transistor with improved video bandwidth for base station applications at frequencies from 1805 MHz to 1995 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	1805 to 1995	3400	28	95	19	28	–33 [1]

[1] Test signal: 3GPP test model 1; 64 DPCH; PAR = 7.5 dB at 0.01 % probability on CCDF; carrier spacing = 5 MHz; f_1 = 1807.5 MHz; f_2 = 1812.5 MHz; f_3 = 1872.5 MHz; f_4 = 1877.5 MHz.

1.2 Features and benefits

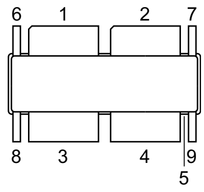
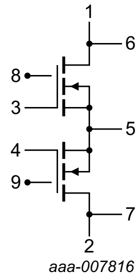
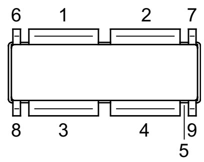
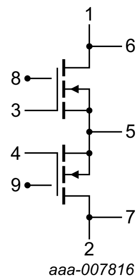
- Decoupling leads to enable improved Video BandWidth (VBW) (120 MHz typical)
- High efficiency
- Low thermal resistance providing excellent thermal stability
- Designed for broadband operation
- Lower output capacitance for improved performance in Doherty applications
- Designed for low memory effects providing excellent pre-distortability
- Internally matched for ease of use
- Integrated ESD protection
- Design optimized for gull-wing
- Excellent ruggedness
- 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 1805 MHz to 1995 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLF8G20LS-400PV (SOT1242B)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		
6	decoupling1		
7	decoupling2		
8	n.c.		
9	n.c.		
BLF8G20LS-400PGV (SOT1242C)			
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		
6	decoupling1		
7	decoupling2		
8	n.c.		
9	n.c.		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF8G20LS-400PV	-	earless flanged ceramic package; 8 leads	SOT1242B
BLF8G20LS-400PGV	-	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 = 80 W	0.23	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 = 3.0 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 300 mA	1.5	1.9	2.3	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	3.0	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V		51.5	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	300	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 15 A	-	20.6	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 10.5 A	-	0.055	-	Ω

Table 7. RF characteristics

Test signal: 2-carrier W-CDMA; PAR = 7.5 dB at 0.01 % probability on the CCDF; 3GPP test model 1; 1-64 DPCH; f_1 = 1807.5 MHz; f_2 = 1812.5 MHz; f_3 = 1872.5 MHz; f_4 = 1877.5 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	17.8	19	-	dB
RL_{in}	input return loss	$P_{L(AV)}$ = 95 W	-	–12	–6	dB
η_D	drain efficiency	$P_{L(AV)}$ = 95 W	24	28	-	%
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	$P_{L(AV)}$ = 95 W	-	–33	–28	dBc

7. Test information

7.1 Ruggedness in class-AB operation

The BLF8G20LS-400PV and BLF8G20LS-400PGV 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} = 3300 mA; 2-carrier W-CDMA signal; P_L = 200 W; f_c = 1800 MHz; 5 MHz spacing, 46 % clipping.

7.2 Impedance information

Table 8. Typical impedance for the top-half of the push-pull package

Measured load-pull data; I_{Dq} = 1800 mA; V_{DS} = 28 V; T_{case} = 25 °C, water cooled.

f	Z_S[1]	Z_L[1]
(MHz)	(Ω)	(Ω)
BLF8G20LS-400PV (straight lead)		
1800	4.1 – j4.66	4.1 – j4.5
1840	5.2 – j3.6	4.4 – j4.4
1880	4.6 – j1.45	4.85 – j4.25
1930	2.8 – j0.3	4.5 – j4.3
1960	2.1 – j0.5	5.5 – j3.5
1990	1.56 – j0.6	5.5 – j3.4
BLF8G20LS-400PGV (gull-wing)		
1800	3.7 – j7.6	4.2 – j6.8
1840	4.34 – j6.1	4.4 – j6.7
1880	4.75 – j5.2	4 – j6.4
1930	3.17 – j3.4	4.6 – j6.5
1960	2 – j3.05	5.8 – j5.5
1990	2.5 – j2.6	5.8– j5.7

[1] Z_S and Z_L defined in Figure 1.

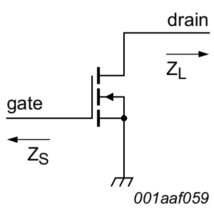
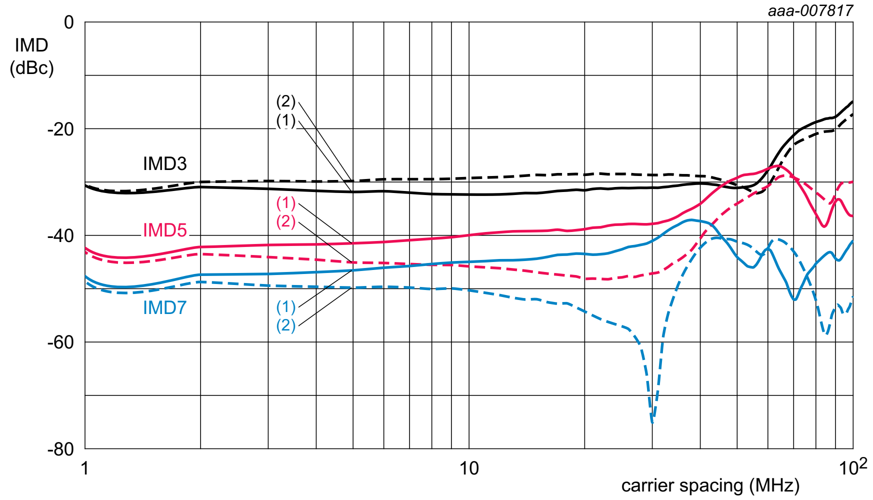


Fig 1. Definition of transistor impedance

7.3 VBW in class-AB operation

The BLF8G20LS-400PV and BLF8G20LS-400PGV have a video bandwidth of 120 MHz (typical) when measured in a class-AB test circuit operating in the 1800 MHz to 1880 MHz frequency band for V_{DS} = 28 V and I_{Dq} = 3.3 A, where the VBW is defined as the location of the resonance in the base-band impedance measurement obtained using a low-frequency probe.

The VBW measurement based on the 2-tone IMD test as a function of carrier spacing is shown below.

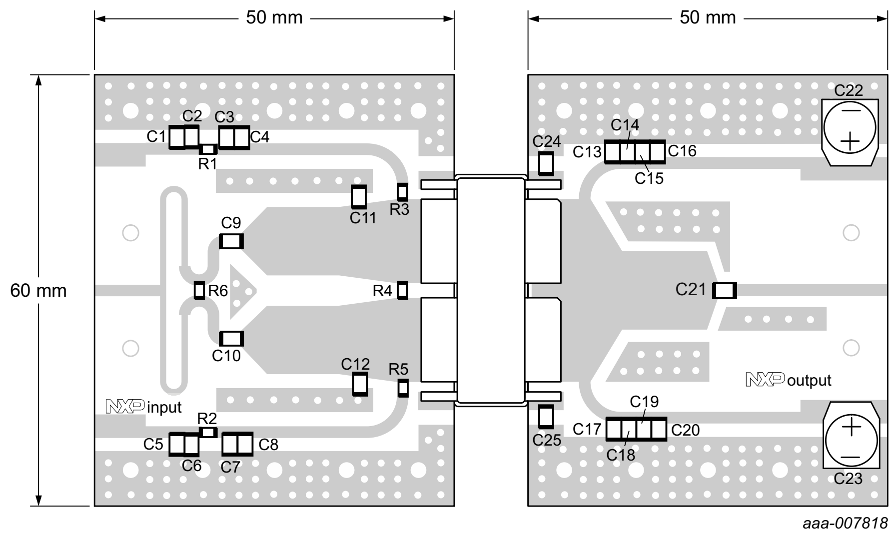


(1) IMD low

(2) IMD high

Fig 2. VBW capacity in a class-AB test circuit

7.4 Test circuit



Printed-Circuit Board (PCB): Rogers 4350B; ε_r = 3.66; thickness = 0.762 mm; thickness copper plating = 35 μm.

See Table 9 for a list of components.

Fig 3. Component layout

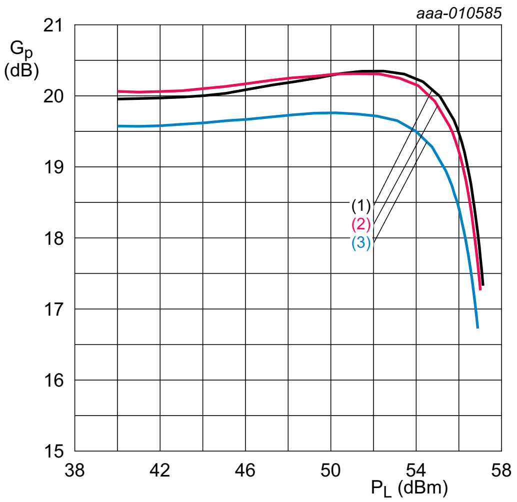
Table 9. List of components

See Figure 3 for component layout.

Component	Description	Value	Remarks
C1, C5, C16, C20	multilayer ceramic chip capacitor	10 μF, 50 V	Murata, SMD 2220
C2, C6, C15, C19, C24, C25	multilayer ceramic chip capacitor	4.7 μF, 50 V	Murata
C3, C7, C14, C18	multilayer ceramic chip capacitor	1 nF	ATC100B
C4, C8, C9, C10, C13, C17, C21	multilayer ceramic chip capacitor	24 pF	ATC100B
C11, C12	multilayer ceramic chip capacitor	100 pF	ATC100B
C22, C23	electrolytic capacitor	2200 μF, 63 V	
R1, R2	resistor	10 Ω	SMD 1206
R3, R5	resistor	5.1 Ω	SMD 1206
R4	resistor	33 Ω	SMD 1206
R6	resistor	100 Ω	SMD 1206

7.5 Graphical data

7.5.1 Pulsed CW



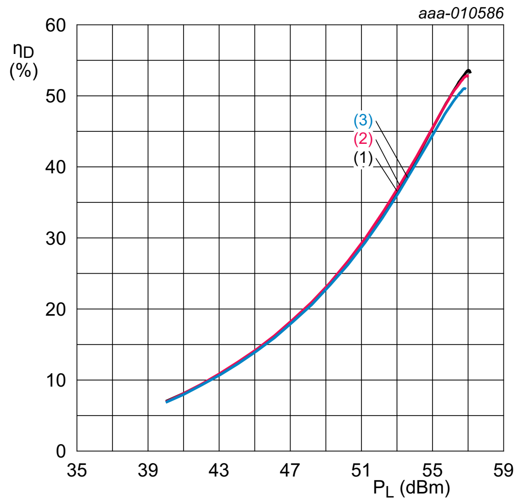
V_{DS} = 28 V; I_{Dq} = 3400 mA; t_p = 100 μs; δ = 10 %.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 4. Power gain as a function of output power; typical values



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

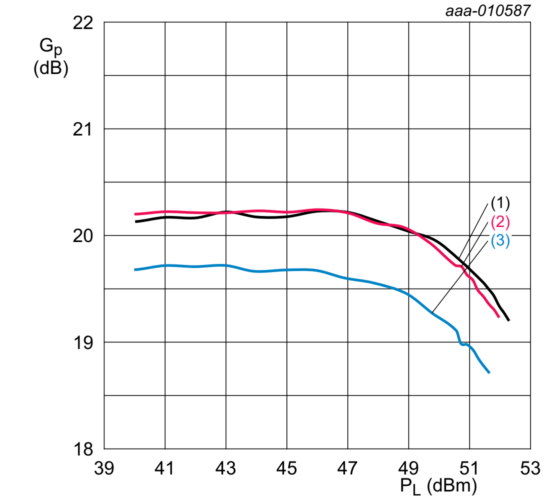
(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 5. Drain efficiency as a function of output power; typical values

7.5.2 IS-95



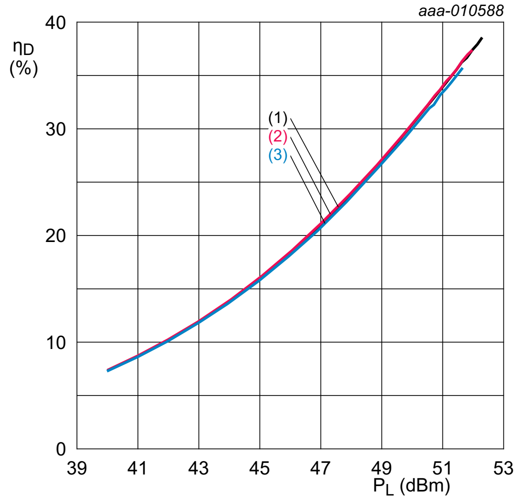
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 6. Power gain as a function of output power; typical values



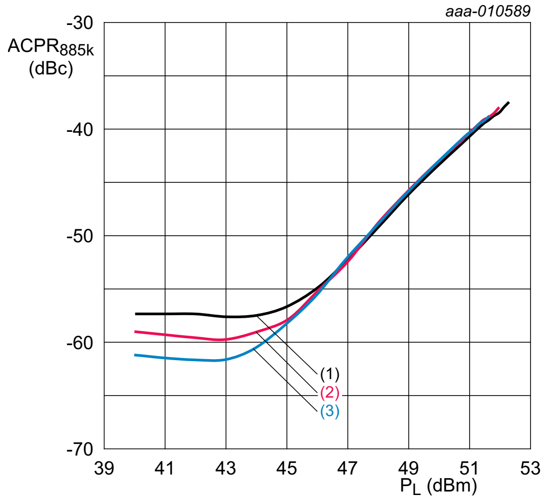
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 7. Drain efficiency as a function of output power; typical values



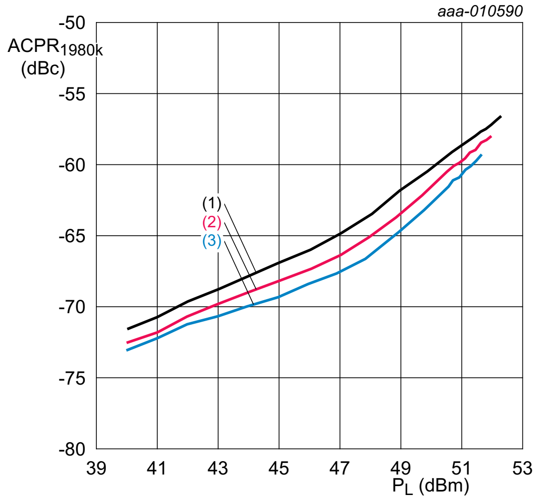
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 8. Adjacent channel power ratio (885 kHz) as a function of output power; typical values



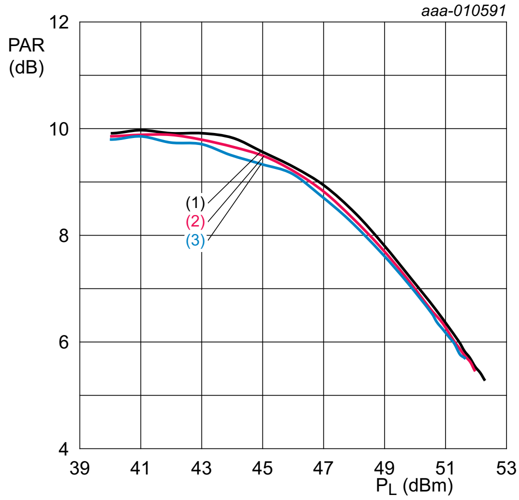
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 9. Adjacent channel power ratio (1980 kHz) as a function of output power; typical values



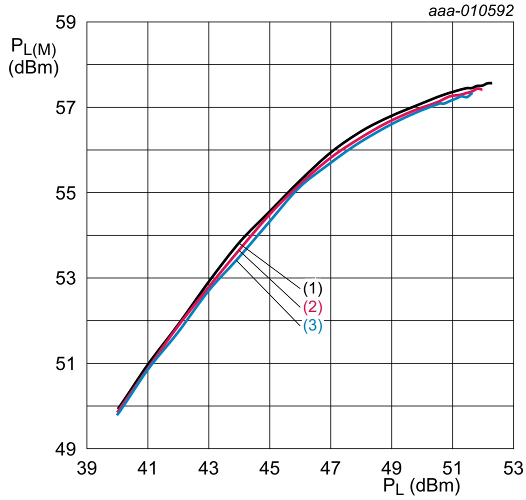
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 10. Peak-to-average ratio as a function of output power; typical values



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

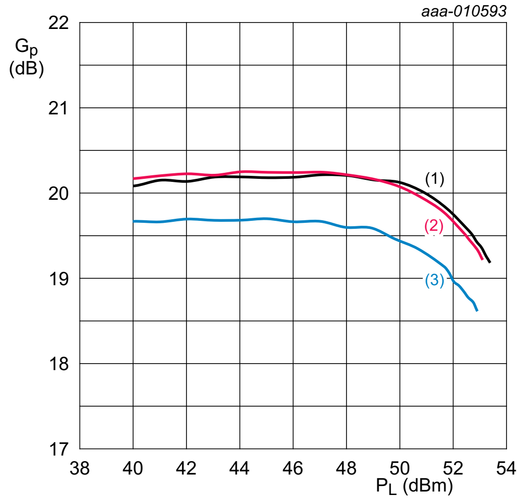
(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

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

7.5.3 1-Carrier W-CDMA



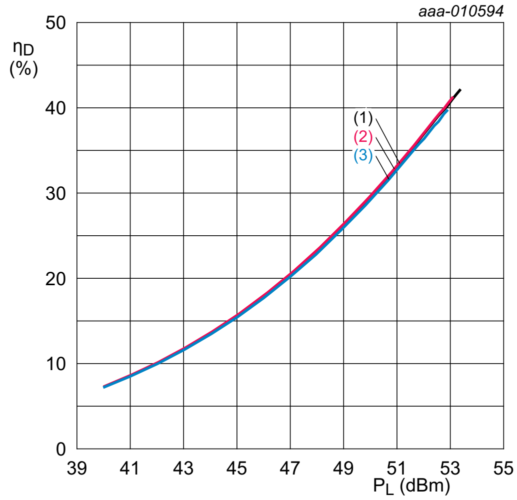
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 12. Power gain as a function of output power; typical values



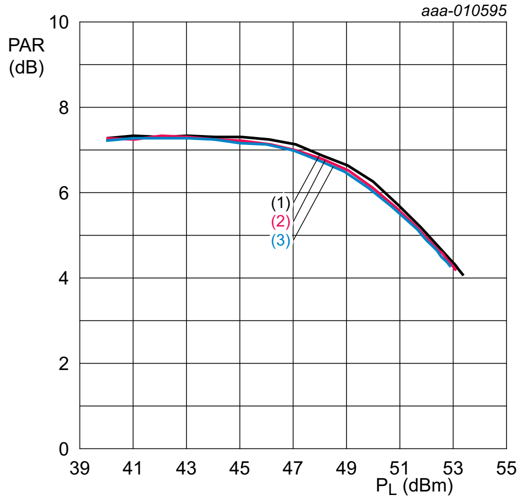
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 13. Drain efficiency as a function of output power; typical values



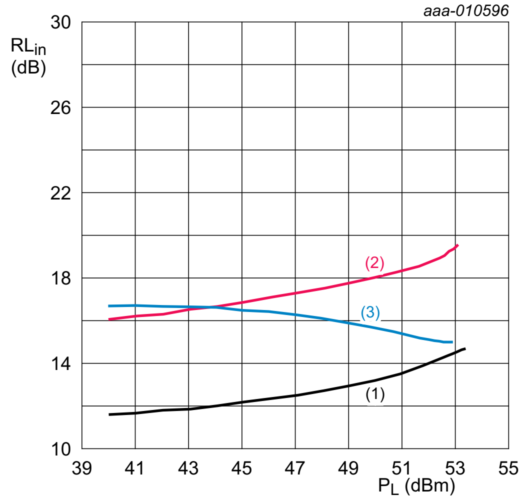
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 14. Peak-to-average ratio as a function of output power; typical values



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

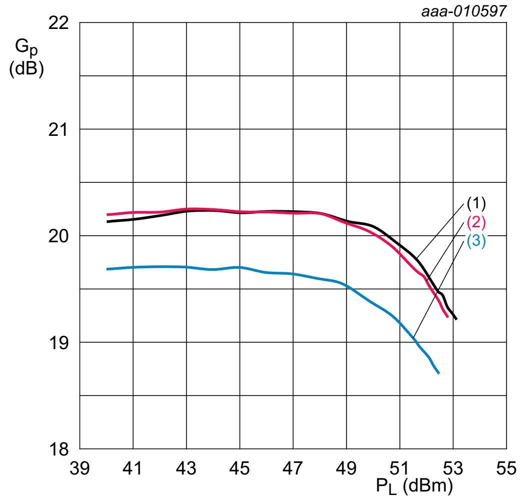
(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 15. Input return loss as a function of output power; typical values

7.5.4 2-Carrier W-CDMA



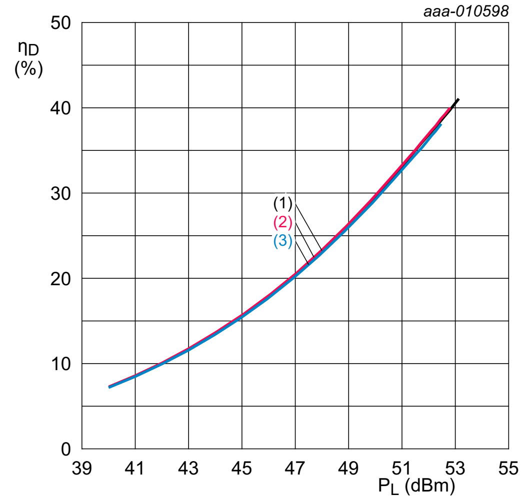
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 16. Power gain as a function of output power; typical values



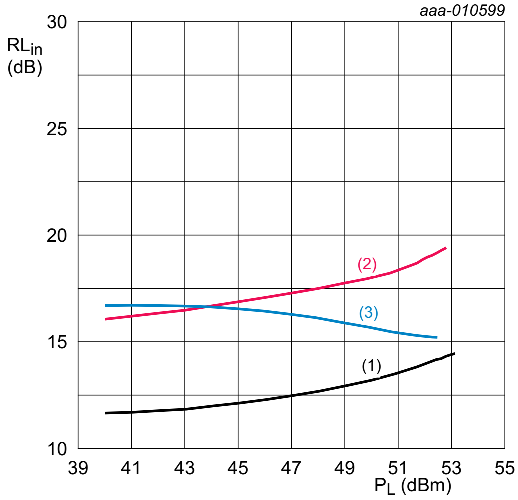
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 17. Drain efficiency as a function of output power; typical values



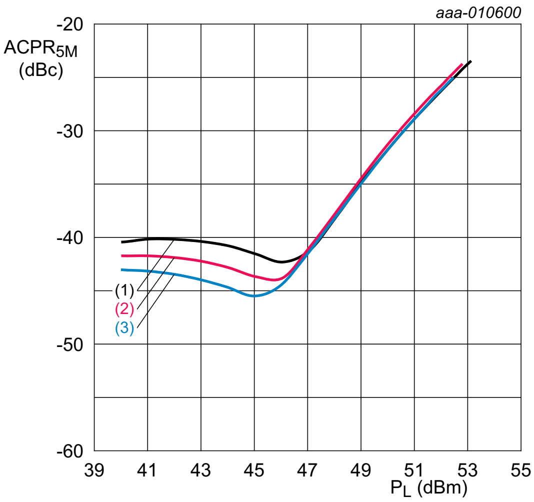
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 18. Input return loss as a function of output power; typical values



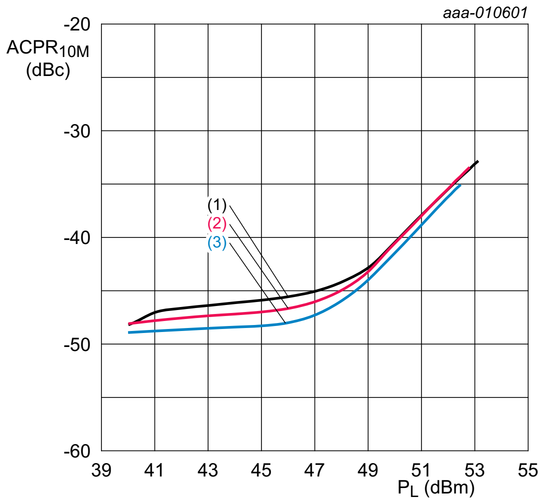
V_{DS} = 28 V; I_{Dq} = 3400 mA.

(1) f = 1805 MHz

(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 19. Adjacent channel power ratio (5 MHz) as a function of output power; typical values



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

(1) f = 1805 MHz

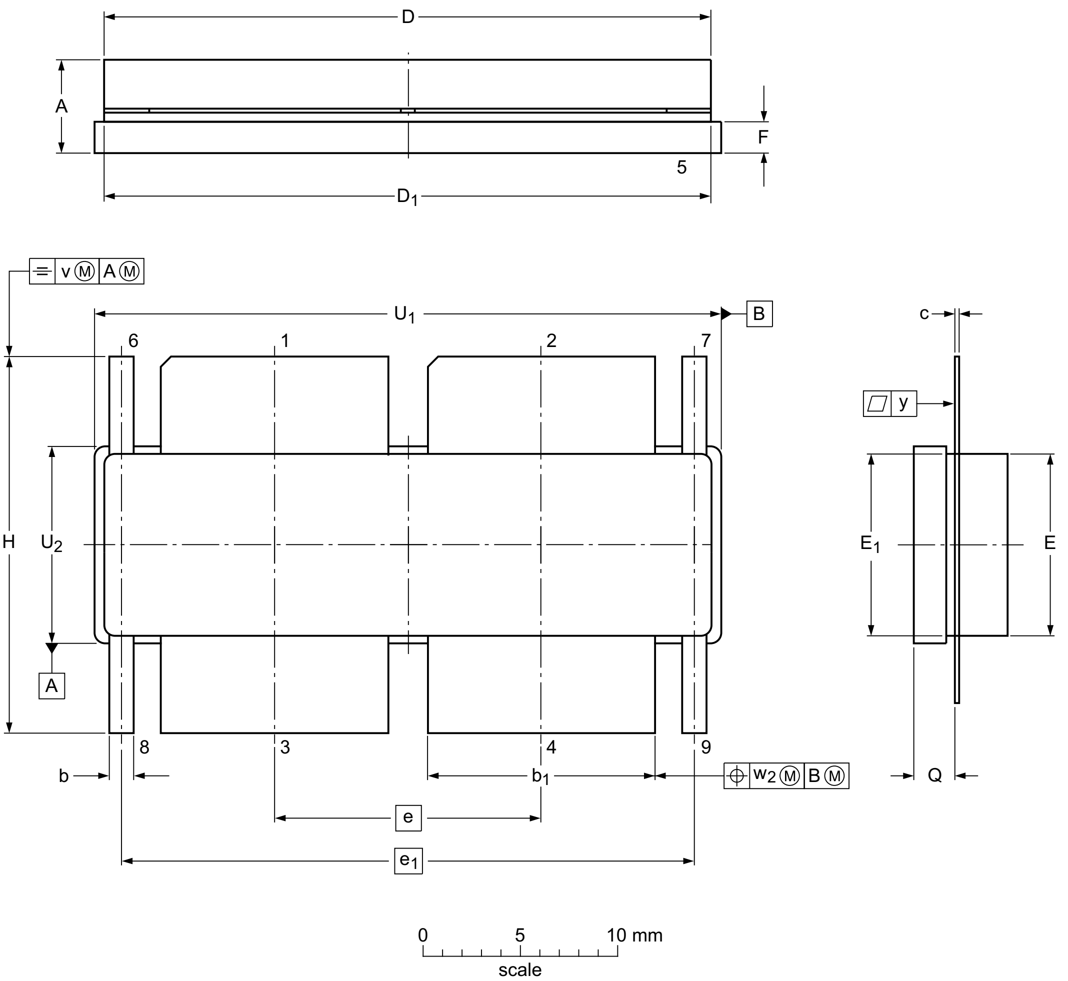
(2) f = 1840 MHz

(3) f = 1880 MHz

Fig 20. Adjacent channel power ratio (10 MHz) as a function of output power; typical values

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	0.10
	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	0.004
	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			

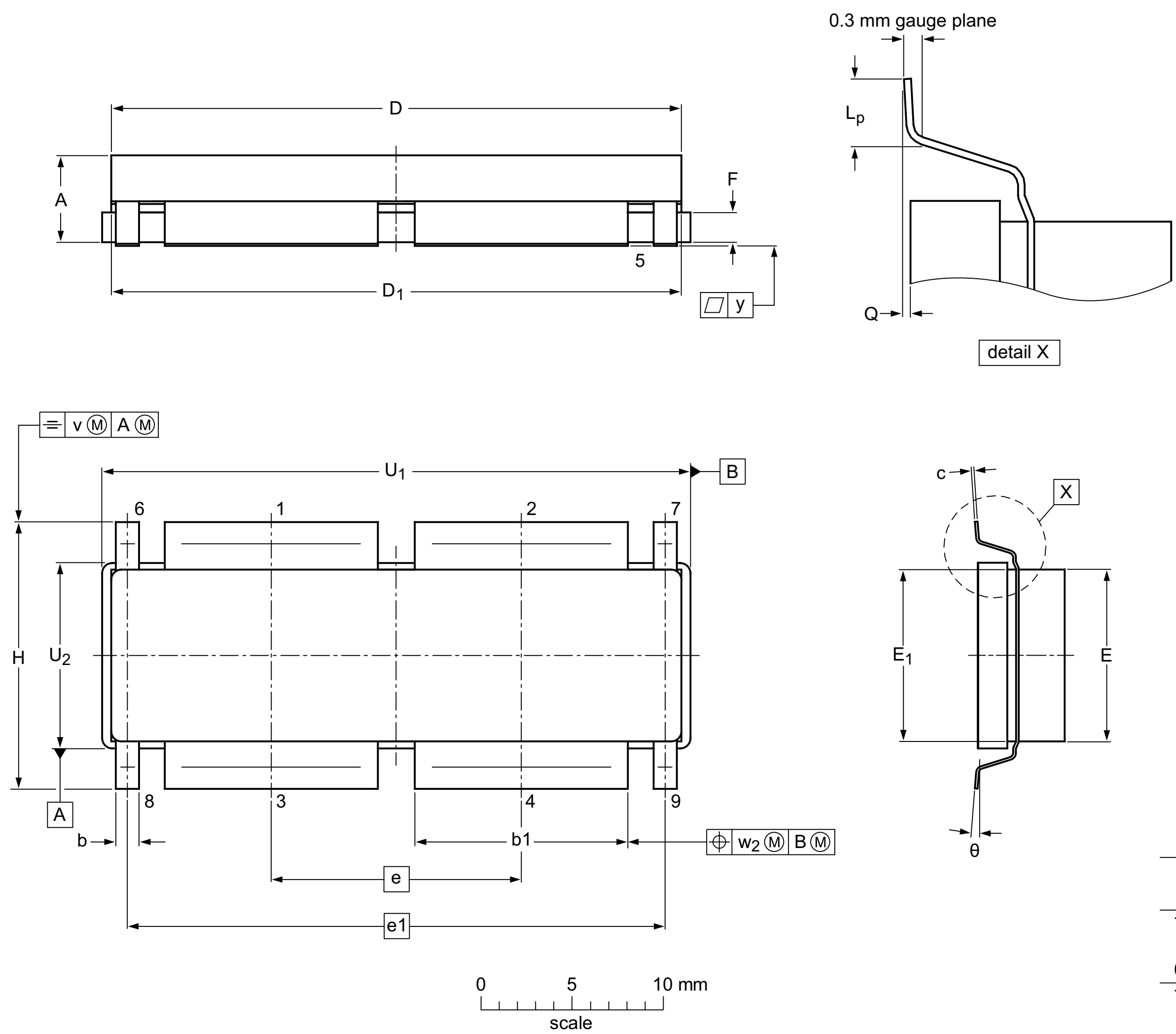
Note
1. Millimeter dimensions are derived from the original inch dimensions.
2. Dimension is measured 0.030 inch (0.76 mm) from the body.

sot1242b_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1242B						~~12-11-28~~ 15-07-21

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	θ
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	7°
	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				0°
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	7°
	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				0°

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

sot1242c_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
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
IMD	InterModulation Distortion
IS-95	Interim Standard 95
LDMOS	Laterally Diffused Metal Oxide Semiconductor
MTF	Median Time to Failure
PAR	Peak-to-Average Ratio
SMD	Surface Mounted Device
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
BLF8G20LS-400PV_LS-400PGV v.4	20150728	Product data sheet	-	BLF8G20LS-400PV _LS-400PGV v.3
Modifications	• Figure Fig 21. on page 12: This figure has been updated			
BLF8G20LS-400PV_LS-400PGV v.3	20140603	Product data sheet	-	BLF8G20LS-400PV _LS-400PGV v.2
BLF8G20LS-400PV_LS-400PGV v.2	20130625	Product data sheet	-	BLF8G20LS-400PV _LS-400PGV v.1
BLF8G20LS-400PV_LS-400PGV v.1	20130606	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.

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