BLM7G1822S-20PB; BLM7G1822S-20PBG

LDMOS 2-stage power MMIC

Rev. 2 — 26 June 2014 Objective data sheet

1. Product profile

1.1 General description

The BLM7G1822S-20PB(G) is a dual section, 2-stage power MMIC using NXP's state of the art GEN7 LDMOS technology. This multiband device is perfectly suited as general purpose driver or small cell final in the frequency range from 1805 MHz to 2170 MHz. Available in gull wing or straight lead outline.

Table 1. Application performance

Typical RF performance at T_{case} = 25 °C; I_{Dq1} = 20 mA; I_{Dq2} = 76 mA.
Test signal: 3GPP test model 1; 64 DPCH; PAR = 10 dB at 0.01% probability on CCDF; per section unless otherwise specified in a class-AB production circuit.

Test signal	f	V_{DS}	$P_{L(AV)}$	G_p	η_D	$ACPR_{5M}$
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)
single carrier W-CDMA	2167.5	28	2	32.2	23.6	–41

1.2 Features and benefits

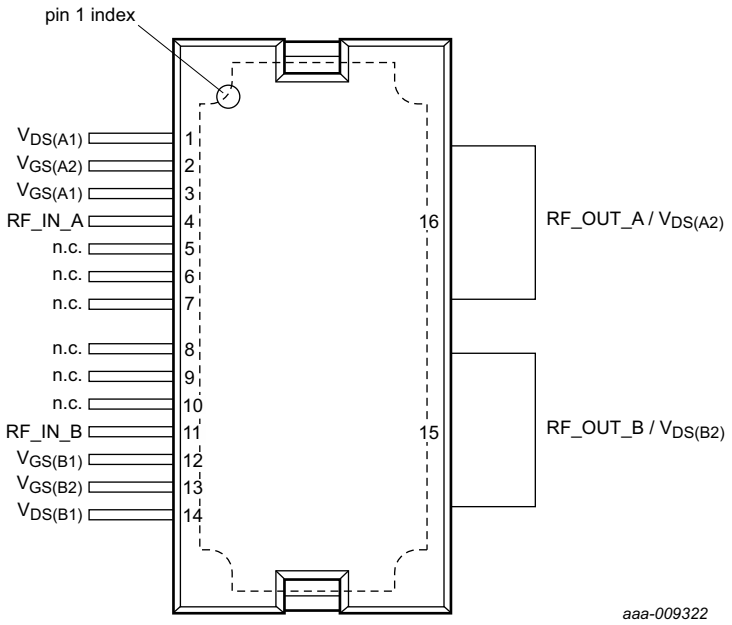
- Designed for broadband operation (frequency 1805 MHz to 2170 MHz)
- High section-to-section isolation enabling multiple combinations
- Integrated temperature compensated bias
- Biasing of individual stages is externally accessible
- Integrated ESD protection
- Excellent thermal stability
- High power gain
- On-chip matching for ease of use
- Compliant to Directive 2002/95/EC, regarding restriction of hazardous substances (RoHS)

1.3 Applications

- RF power MMIC for W-CDMA base stations in the 1805 MHz to 2170 MHz frequency range. Possible circuit topologies are the following as also depicted in Section 8.1:
  - Dual section or single ended
  - Doherty
  - Quadrature combined
  - Push-pull

2. Pinning information

2.1 Pinning



Transparent top view

The exposed backside of the package is the ground terminal of the device.

Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$V_{DS(A1)}$	1	drain-source voltage of stage A1
$V_{GS(A2)}$	2	gate-source voltage of stage A2
$V_{GS(A1)}$	3	gate-source voltage of stage A1
RF_IN_A	4	RF input section A
n.c.	5	not connected
n.c.	6	not connected
n.c.	7	not connected
n.c.	8	not connected
n.c.	9	not connected
n.c.	10	not connected
RF_IN_B	11	RF input section B
$V_{GS(B1)}$	12	gate-source voltage of stage B1
$V_{GS(B2)}$	13	gate-source voltage of stage B2
$V_{DS(B1)}$	14	drain-source voltage of stage B1

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Table 2. Pin description *...continued*

Symbol	Pin	Description
RF_OUT_B/$V_{DS(B2)}$	15	RF output section B / drain-source voltage of stage B2
RF_OUT_A/$V_{DS(A2)}$	16	RF output section A / drain-source voltage of stage A2
GND	flange	RF ground

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLM7G1822S-20PB	HSOP16F	plastic, heatsink small outline package; 16 leads (flat)	SOT1211-1
BLM7G1822S-20PBG	HSOP16	plastic, heatsink small outline package; 16 leads	SOT1212-1

4. Block diagram

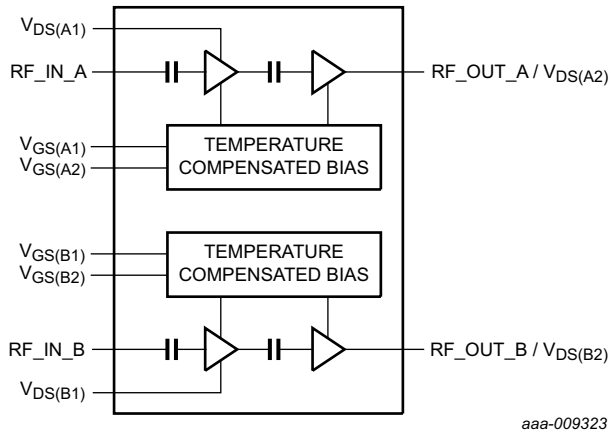

Fig 2. Block diagram

5. 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
T_{case}	case temperature		-	150	°C

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

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6. Thermal characteristics

Table 5. Thermal characteristics

Measured for total device.

Symbol	Parameter	Conditions		Value	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	final stage; T_{case} = 90 °C; P_L = 3.56 W	[1]	1.9	K/W
		driver stage; T_{case} = 90 °C; P_L = 3.56 W	[1]	6.2	K/W

[1] When operated with a CW signal.

7. Characteristics

Table 6. DC characteristics

T_{case} = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Final stage						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 150.8 μA	65	-	-	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 76 mA	1.5	2	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = 5.65 V; V_{DS} = 10 V	-	2.8	-	A
I_{GSS}	gate leakage current	V_{GS} = 1.0 V; V_{DS} = 0 V	-	-	140	nA
Driver stage						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 30.16 μA	65	-	-	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 20 mA	1.6	2.1	2.6	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = 5.65 V; V_{DS} = 10 V	-	0.55	-	A
I_{GSS}	gate leakage current	V_{GS} = 1.0 V; V_{DS} = 0 V	-	-	140	nA

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Table 7. RF Characteristics

Typical RF performance at T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 20 mA; I_{Dq2} = 76 mA; $P_{L(AV)}$ = 2 W. Per section unless otherwise specified, measured in a NXP wideband f = 1807.5 MHz to 2167.5 MHz straight lead production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: single carrier W-CDMA [1]						
G_p	power gain	f = 1807.5 MHz	-	33.6	-	dB
		f = 2167.5 MHz	30.7	32.2	33.7	dB
η_D	drain efficiency	f = 1807.5 MHz	-	22	-	%
		f = 2167.5 MHz	21	23.6	-	%
RL_{in}	input return loss	f = 2167.5 MHz	-	−25	−14	dB
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	f = 1807.5 MHz	-	−41	-	dBc
		f = 2167.5 MHz	-	−41	−37	dBc
PAR_O	output peak-to-average ratio	f = 1807.5 MHz	-	8.4	-	dB
		f = 2167.5 MHz	7.8	8.4	-	dB
$\Delta I_{Dq}/\Delta T$	quiescent drain current variation with temperature	T = −40 °C to +85 °C				
		final stage I_{Dq}; gate feed resistor = 1105 Ω	-	±1	-	%
		driver stage I_{Dq}; gate feed resistor = 765 Ω	-	±1	-	%
Test signal: CW [2]						
$\Delta\varphi_{s21}$	phase response difference	between sections	−10	-	+10	deg
$\Delta\|s_{21}\|^2$	insertion power gain difference	between sections	−0.5	-	+0.5	dB

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

[2] f = 2170 MHz.

8. Application information

Table 8. Typical performance

Test signal: 1-tone CW; RF performance at T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 45 mA (both sections); I_{Dq2} = 140 mA (both sections) unless otherwise specified, measured in a NXP wideband f = 2110 MHz to 2170 MHz straight lead class AB application circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(1dB)}$	output power at 1 dB gain compression	f = 2140 MHz	-	43.5	-	W
$P_{L(3dB)}$	output power at 3 dB gain compression	f = 2140 MHz	-	44.1	-	W
η_D	drain efficiency	at $P_{L(1dB)}$; f = 2140 MHz	-	47.6	-	%
G_p	power gain	$P_{L(AV)}$ = 1.585 W; f = 2140 MHz	-	31.5	-	dB
B_{video}	video bandwidth	2-tone CW; $P_{L(AV)}$ = 1.585 W; f = 2140 MHz	-	170	-	MHz
G_{flat}	gain flatness	over a frequency range of 60 MHz; $P_{L(AV)}$ = 1.585 W	-	0.4	-	dB
$\Delta G/\Delta T$	gain variation with temperature	f = 2140 MHz	-	0.03	-	dB/°C
$\|s_{12}\|^2$	isolation	between sections A and B; [1] $P_{L(AV)}$ = 1.585 W; f = 2140 MHz	-	28.5	-	dB
K	Rollett stability factor	T = −40 °C; f = 0.1 GHz to 3 GHz	-	>1	-	

[1] Measured on dual section evaluation board I_{Dq1} = 40 mA (both sections); I_{Dq2} = 150 mA (both sections).

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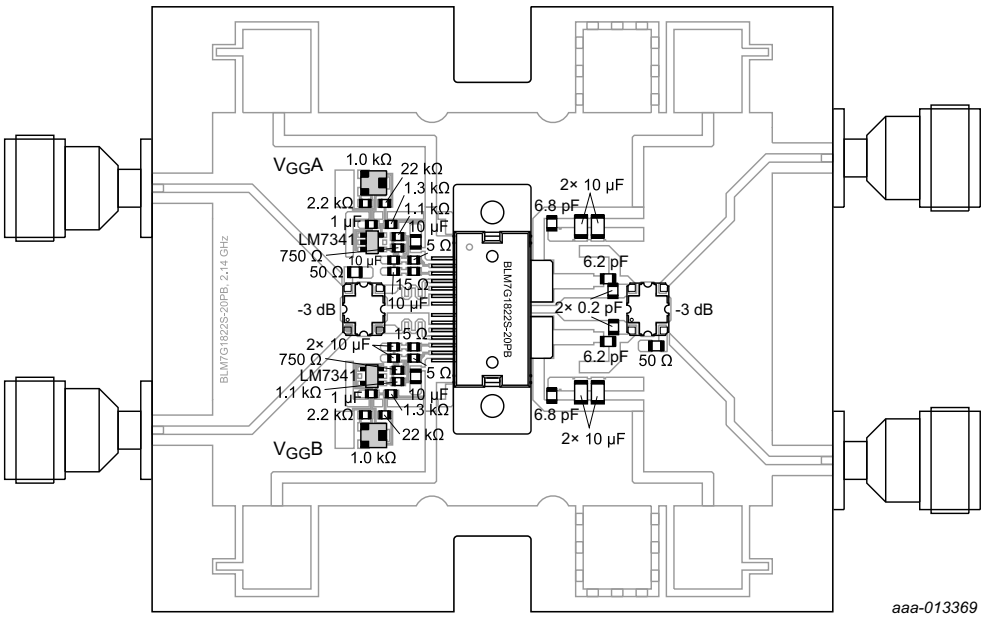

Printed-Circuit Board (PCB): Rogers 4350; thickness = 0.508 mm.

Fig 3. Component layout for class-AB application circuit

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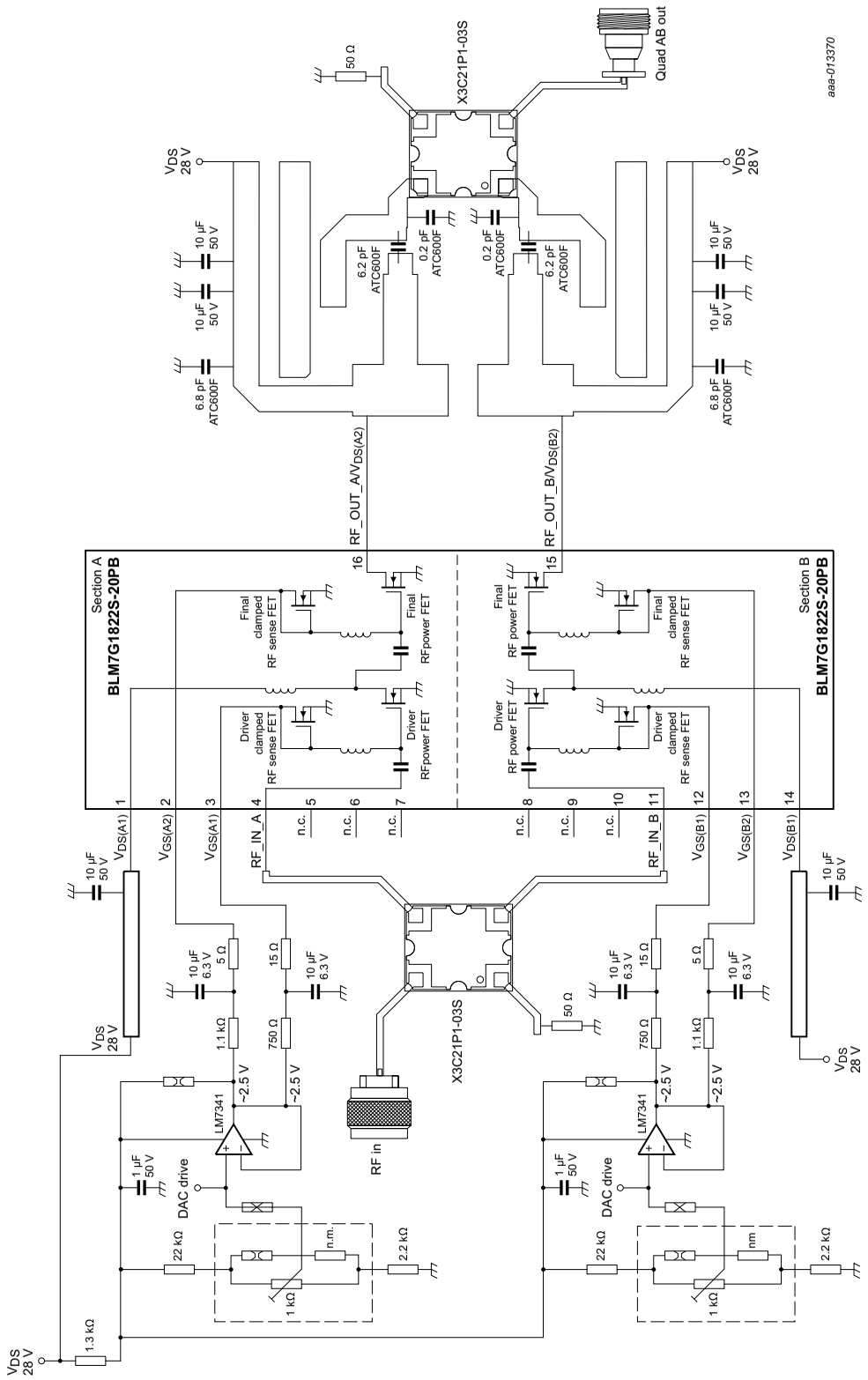

Fig 4. Electrical schematic

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8.1 Possible circuit topologies

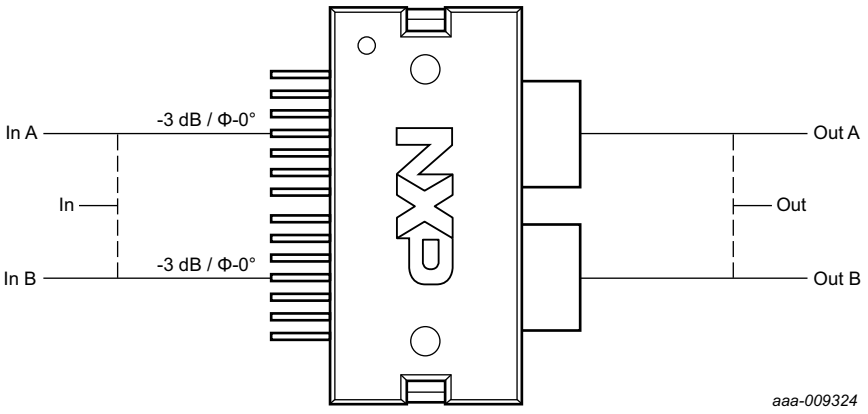

Fig 5. Dual section or single ended

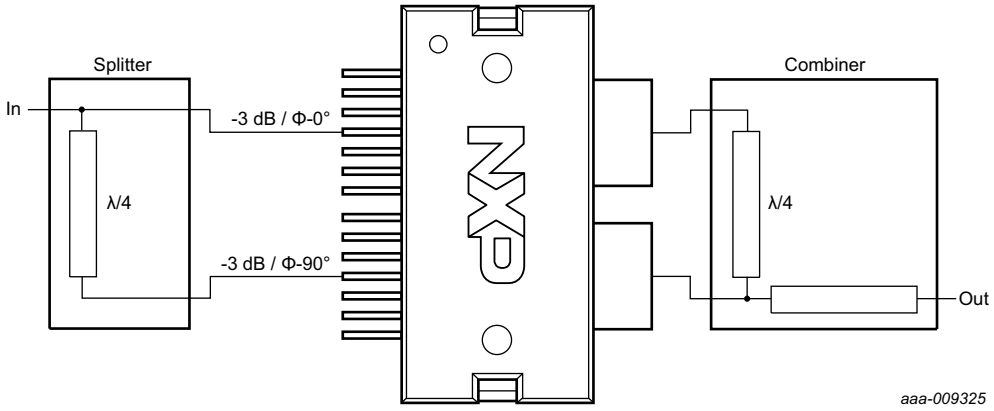

Fig 6. Doherty

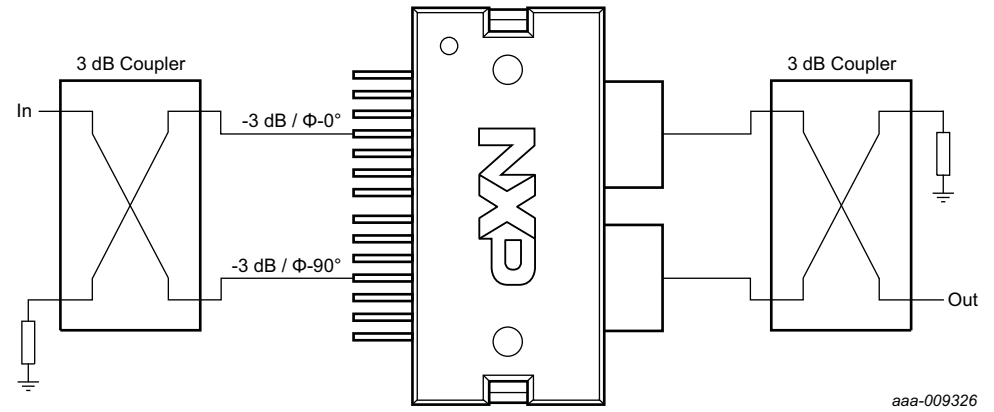

Fig 7. Quadrature combined

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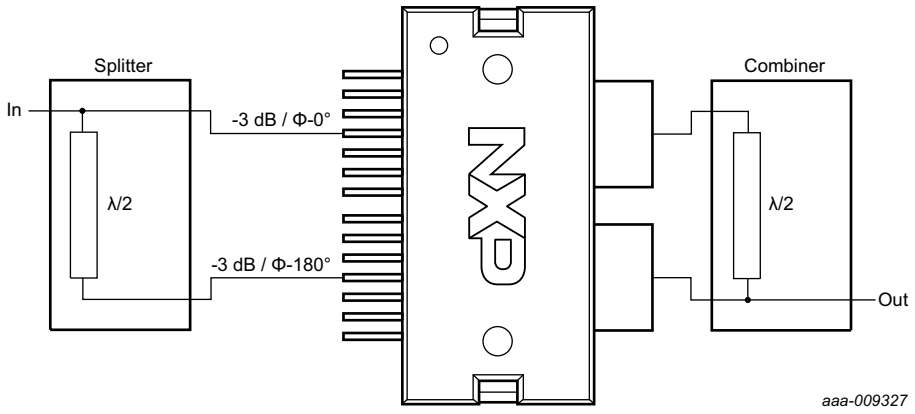

Fig 8. Push-pull

8.2 Ruggedness in class-AB operation

The BLM7G1822S-20PB and BLM7G1822S-20PBG are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 32 V; I_{Dq1} = 20 mA; I_{Dq2} = 75 mA; P_i = 16 dBm (CW); f = 2140 MHz.

8.3 Impedance information

Table 9. Typical impedance tuned for maximum output power

Measured load-pull data per section; test signal: pulsed CW; T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 20 mA; I_{Dq2} = 65 mA; t_p = 100 µs; δ = 10 %; Z_S = 50 Ω. Typical values unless otherwise specified.

f	tuned for maximum output power					tuned for maximum power added efficiency				
	Z_L	$G_{p(max)}$	P_L	η_{add}	AM-PM conversion	Z_L	$G_{p(max)}$	P_L	η_{add}	AM-PM conversion
(MHz)	(Ω)	(dB)	(W)	(%)	(deg)	(Ω)	(dB)	(W)	(%)	(deg)
BLM7G1822S-20PB										
1700	16.9 – j13.0	34.7	42.5	50.4	8.0	29.6 – j19.1	36.1	41.5	57.5	8.6
1800	17.0 – j10.8	33.9	42.5	51.0	6.4	31.2 – j8.82	35.1	41.6	57.5	6.6
1900	16.5 – j9.42	32.8	42.6	51.6	5.7	26.4 – j1.39	33.8	41.7	57.0	6.4
2000	15.6 – j8.32	32.0	42.6	51.6	5.7	20.3 + j1.03	33.0	41.8	56.1	6.8
2100	14.7 – j7.58	32.0	42.7	50.3	5.6	16.0 + j1.62	33.2	41.7	55.5	6.8
2200	13.8 – j7.32	31.8	42.6	49.4	6.4	12.9 + j1.14	33.2	41.6	54.8	7.2
2300	12.6 – j6.97	31.7	42.5	49.2	7.3	10.7 + j0.34	32.7	41.7	53.6	8.3
BLM7G1822S-20PBG										
1700	17.2 – j15.2	34.9	42.7	52.7	8.3	29.8 – j18.5	36.0	41.9	58.9	9.2
1800	17.2 – j13.1	34.2	42.6	52.0	6.3	30.0 – j9.60	35.2	41.8	57.8	7.0
1900	16.7 – j10.9	33.0	42.7	50.8	6.1	26.1 – j1.90	34.0	41.8	56.5	6.9
2000	15.7 – j9.70	32.3	42.7	49.7	6.1	19.9 + j0.30	33.2	41.8	55.5	7.3
2100	14.5 – j9.10	32.0	42.7	49.4	6.9	15.3 – j0.00	32.9	41.8	55.0	8.6
2200	13.6 – j8.60	31.7	42.6	49.2	8.5	12.8 – j0.90	32.7	41.8	54.3	9.6
2300	12.6 – j8.30	31.5	42.5	49.4	10.6	11.5 – j1.90	32.4	41.8	54.0	10.3

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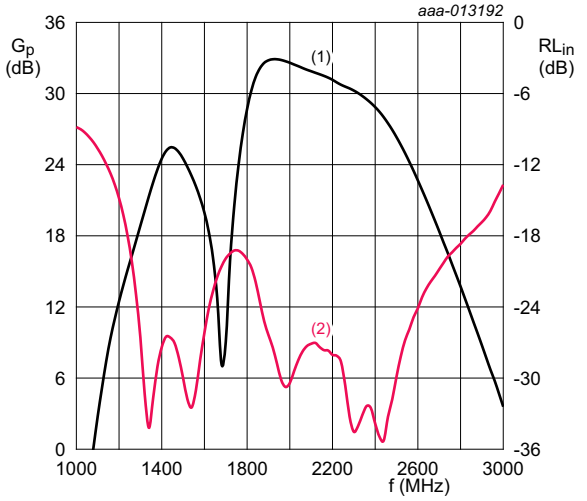
8.4 Graphs

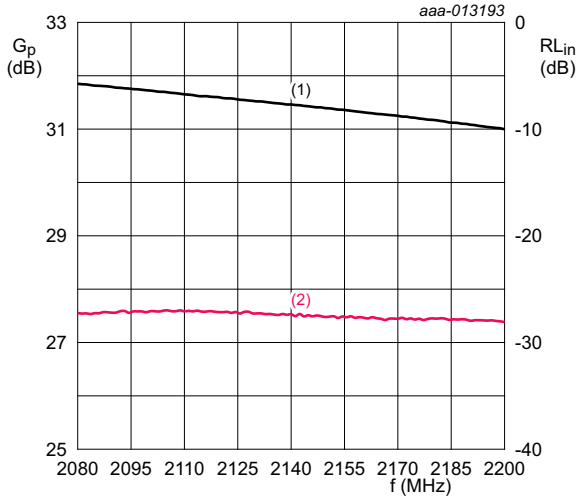


T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 22 mA; I_{Dq2} = 70 mA; P_L = 1.585 W. Per section.

(1) magnitude of G_p

(2) magnitude of RL_{in}

Fig 9. Wideband power gain and input return loss as function of frequency; typical values

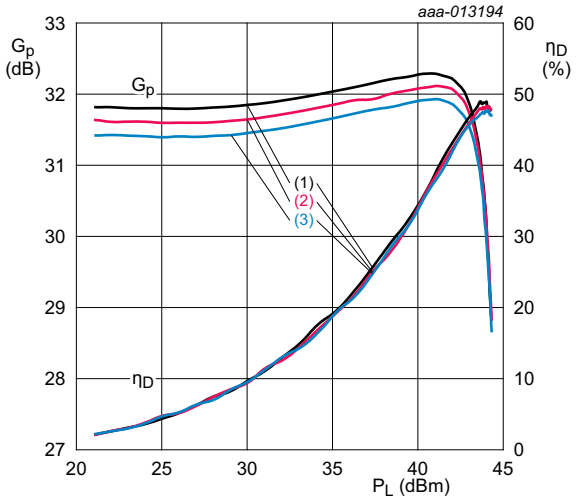


T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 22 mA; I_{Dq2} = 70 mA; P_L = 1.585 W. Per section.

(1) magnitude of G_p

(2) magnitude of RL_{in}

Fig 10. In-band power gain and input return loss as function of frequency; typical values



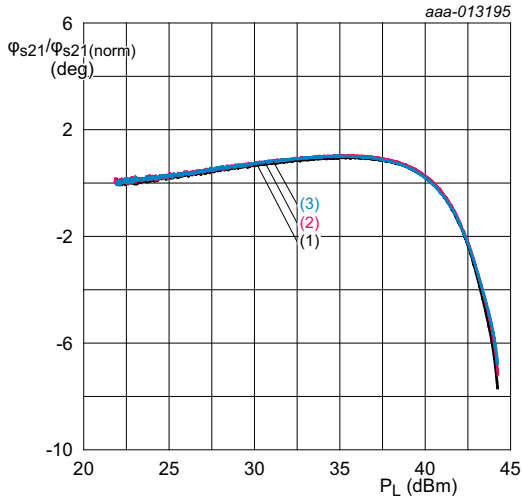
T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 22 mA; I_{Dq2} = 70 mA. Per section.

(1) f = 2110 MHz

(2) f = 2140 MHz

(3) f = 2170 MHz

Fig 11. Power gain and drain efficiency as function of output power; typical values



Normalized at P_L = 22 dBm; T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 22 mA; I_{Dq2} = 70 mA. Per section.

(1) f = 2110 MHz

(2) f = 2140 MHz

(3) f = 2170 MHz

Fig 12. Normalized phase response as a function of output power; typical values

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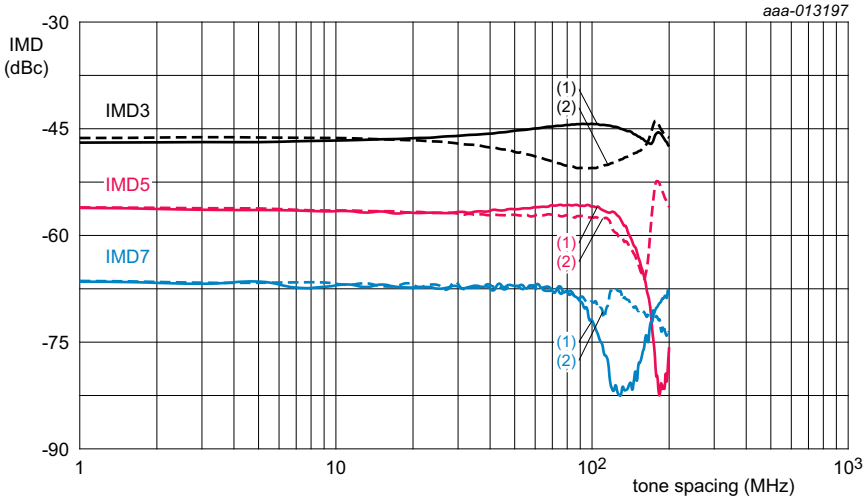
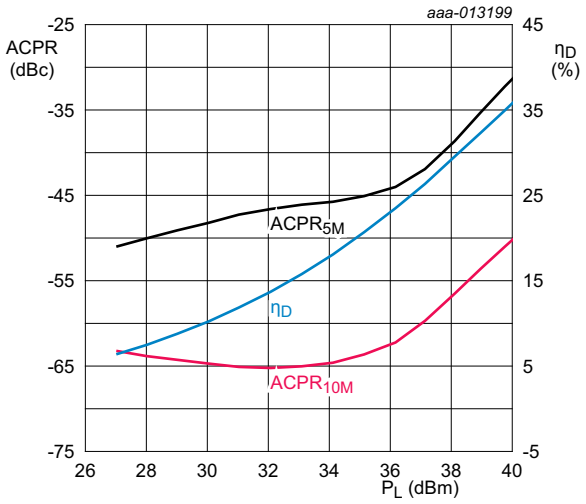


T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 22 mA; I_{Dq2} = 70 mA; f = 2140 MHz; 2-tone CW; $P_{L(AV)}$ = 0.25 W. Per section.

(1) IMD low

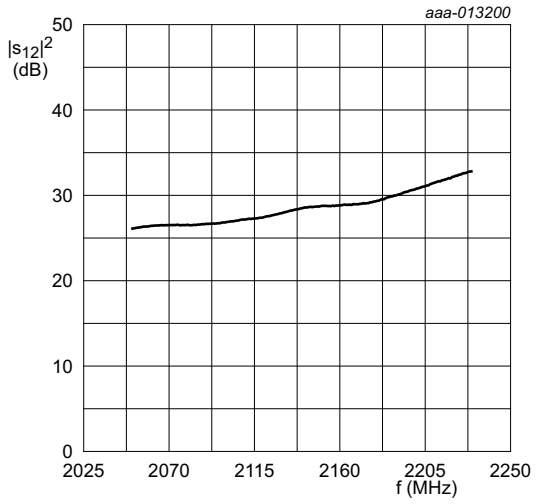
(2) IMD high

Fig 13. Intermodulation distortion as a function of tone spacing; typical values



T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 22 mA; I_{Dq2} = 70 mA; f = 2140 MHz; 1-carrier W-CDMA; test model 1; PAR = 7.2 dB at 0.01 % probability on CCDF. Per section.

Fig 14. Adjacent channel power ratio and drain efficiency as function of output power; typical values



T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 20 mA; I_{Dq2} = 75 mA. Per section. Measured on evaluation board.

Fig 15. Isolation as a function of frequency; typical values

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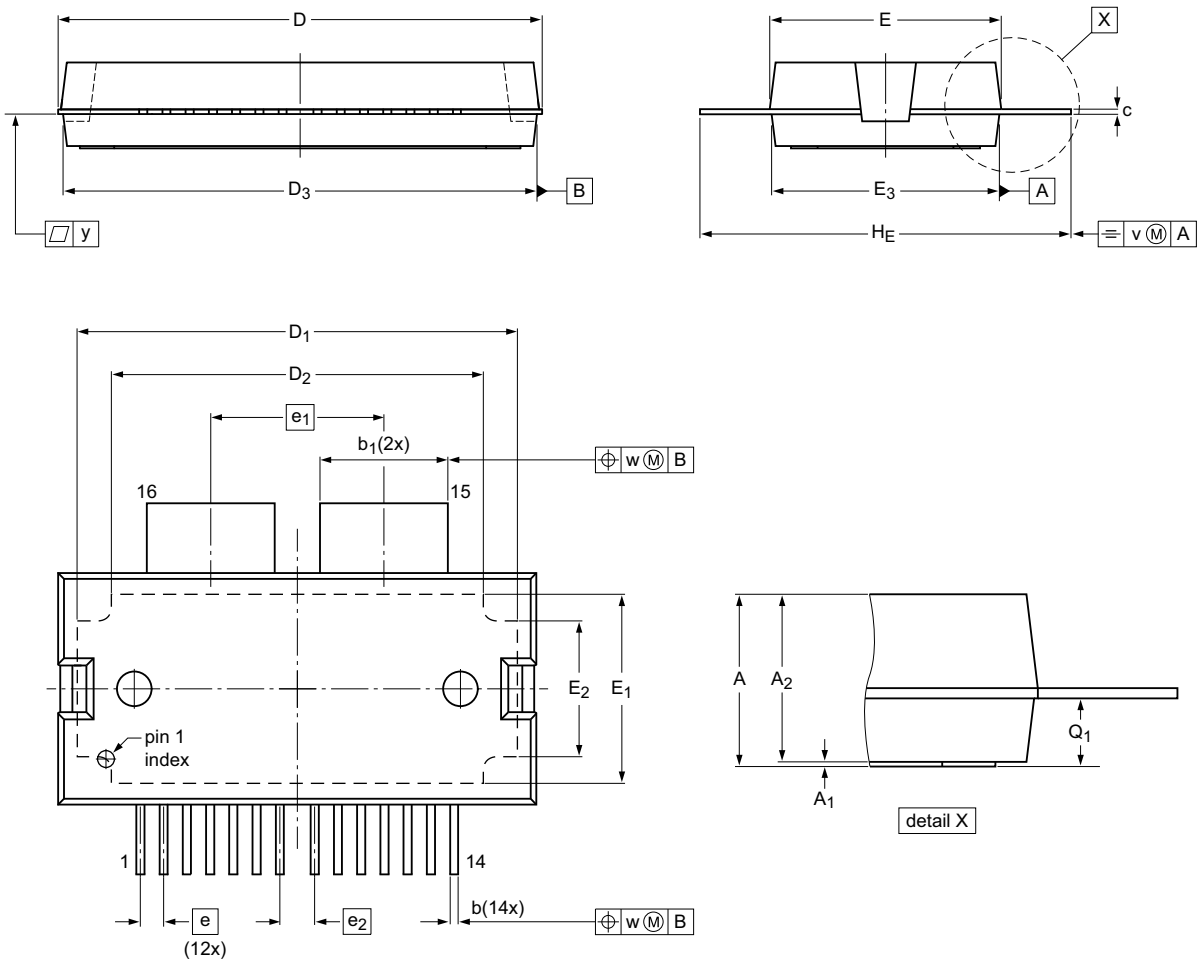
9. Package outline

HSOP16F: plastic, heatsink small outline package; 16 leads(flat) **SOT1211-1**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	b	b_1	c	$D^{(1)}$	D_1	D_2	D_3	$E^{(1)}$	E_1	E_2	E_3	e	e_1	e_2	H_E	Q_1	v	w	y
mm	max	3.9	0.2	3.65	0.40	5.55	0.27	20.62	19.00	16.05	20.44	10.01	8.18	5.89	9.83				16.16	1.62			
	nom		0.1	3.60	0.35	5.50	0.22	20.57	18.95	16.00	20.39	9.96	8.13	5.84	9.78	1.0	7.45	1.5	15.96	1.57	0.25	0.25	0.1
	min		0	3.55	0.30	5.45	0.17	20.52	18.90	15.95	20.34	9.91	8.08	5.79	9.73				15.76	1.52			

Note
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

sot1211-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1211-1						~~13-10-18~~ 13-10-22

Fig 16. Package outline SOT1211-1 (HSOP16F)

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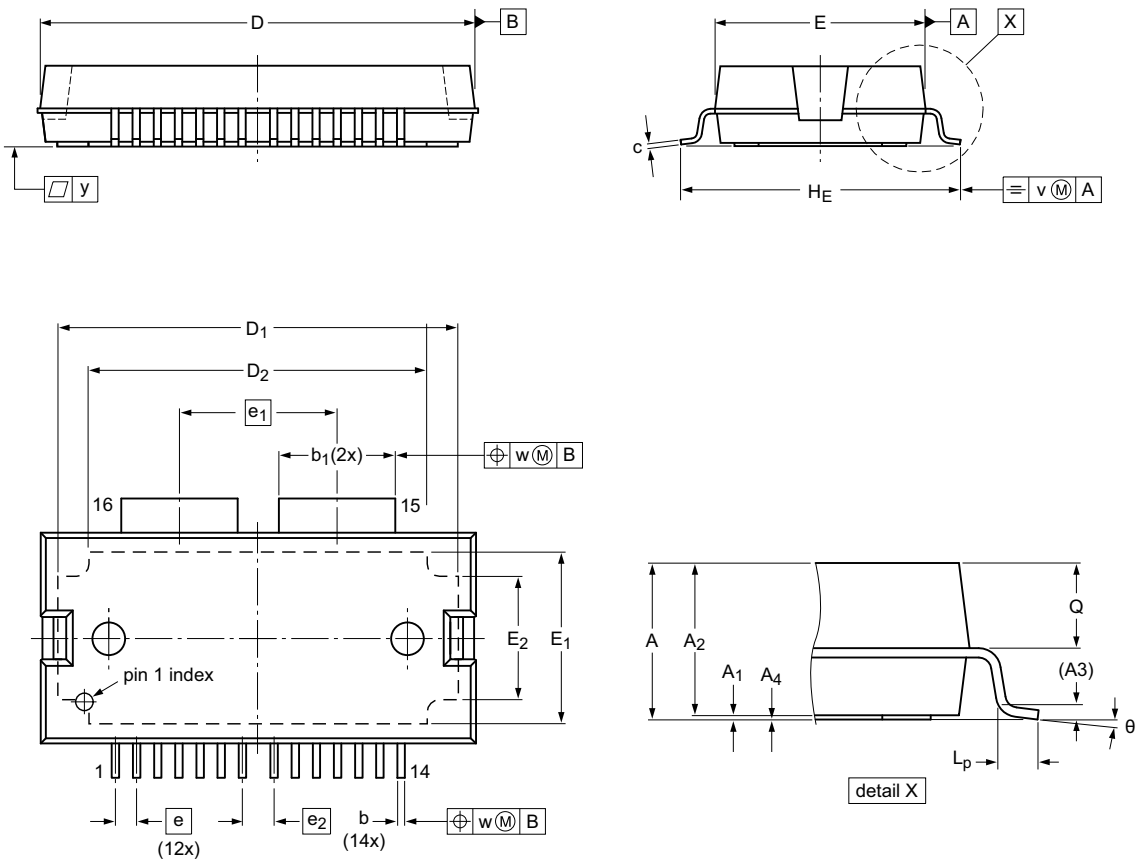
HSOP16: plastic, heatsink small outline package; 16 leads **SOT1212-1**



w	y	θ
0.25	0.1	7° 3° 0°

Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	A_4	b	b_1	c	$D^{(1)}$	D_1	D_2	$E^{(1)}$	E_1	E_2	e	e_1	e_2	H_E	L_p	Q	v
mm	max	3.9	0.2	3.65		0.06	0.40	5.55	0.27	20.62	19.00	16.05	10.01	8.18	5.89				13.5	1.10	2.07	
	nom		0.1	3.60	0.35	0	0.35	5.50	0.22	20.57	18.95	16.00	9.96	8.13	5.84	1.0	7.45	1.5	13.2	0.95	2.02	0.25
	min		0	3.55		-0.02	0.30	5.45	0.17	20.52	18.90	15.95	9.91	8.08	5.79				12.9	0.80	1.97	

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

sot1212-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1212-1						~~12-05-14~~ 12-05-21

Fig 17. Package outline SOT1212-1 (HSOP16)

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10. 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.

11. Abbreviations

Table 10. Abbreviations

Acronym	Description
AM	Amplitude Modulation
3GPP	3rd Generation Partnership Project
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
DPCH	Dedicated Physical CHannel
ESD	ElectroStatic Discharge
GEN7	Seventh Generation
LDMOS	Laterally Diffused Metal Oxide Semiconductor
MMIC	Monolithic Microwave Integrated Circuit
MTF	Median Time to Failure
PAR	Peak-to-Average Ratio
PM	Phase Modulation
VSWR	Voltage Standing-Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

12. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLM7G1822S-20PB_S-20PBG v.2	20140626	Objective data sheet	-	BLM7G1822S-20PB_S-20PBG v.1
Modifications:	• Section 1.1 on page 1, the section has been updated • Table 5 on page 4, the table has been updated • Table 6 on page 4, the table has been updated • Table 7 on page 5, the table has been updated • Section 8 on page 5, the section has been added			
BLM7G1822S-20PB_S-20PBG v.1	20131219	Objective data sheet	-	-

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13.1 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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15. Contents

1	**Product profile**	**1**
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
2	**Pinning information**	**2**
2.1	Pinning	2
2.2	Pin description	2
3	**Ordering information**	**3**
4	**Block diagram**	**3**
5	**Limiting values**	**3**
6	**Thermal characteristics**	**4**
7	**Characteristics**	**4**
8	**Application information**	**5**
8.1	Possible circuit topologies	8
8.2	Ruggedness in class-AB operation	9
8.3	Impedance information	9
8.4	Graphs	10
9	**Package outline**	**12**
10	**Handling information**	**14**
11	**Abbreviations**	**14**
12	**Revision history**	**14**
13	**Legal information**	**15**
13.1	Data sheet status	15
13.2	Definitions	15
13.3	Disclaimers	15
13.4	Trademarks	16
14	**Contact information**	**16**
15	**Contents**	**17**

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