

BLM8G0710S-60PB; BLM8G0710S-60PBG

LDMOS 2-stage power MMIC

Rev. 2 — 22 March 2016

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The BLM8G0710S-60PB(G) is a dual section, 2-stage power MMIC using Ampleon's state of the art GEN8 LDMOS technology. This multiband device is perfectly suited as general purpose driver or small cell final in the frequency range from 700 MHz to 1000 MHz. Available in gull wing or straight lead outline.

Table 1. Performance

Typical RF performance at $T_{case} = 25\text{ }^{\circ}\text{C}$.

Test signal: 3GPP test model 1; 64 DPCH; PAR = 9.9 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	957.5	28	6	34.7	26	-40

1.2 Features and benefits

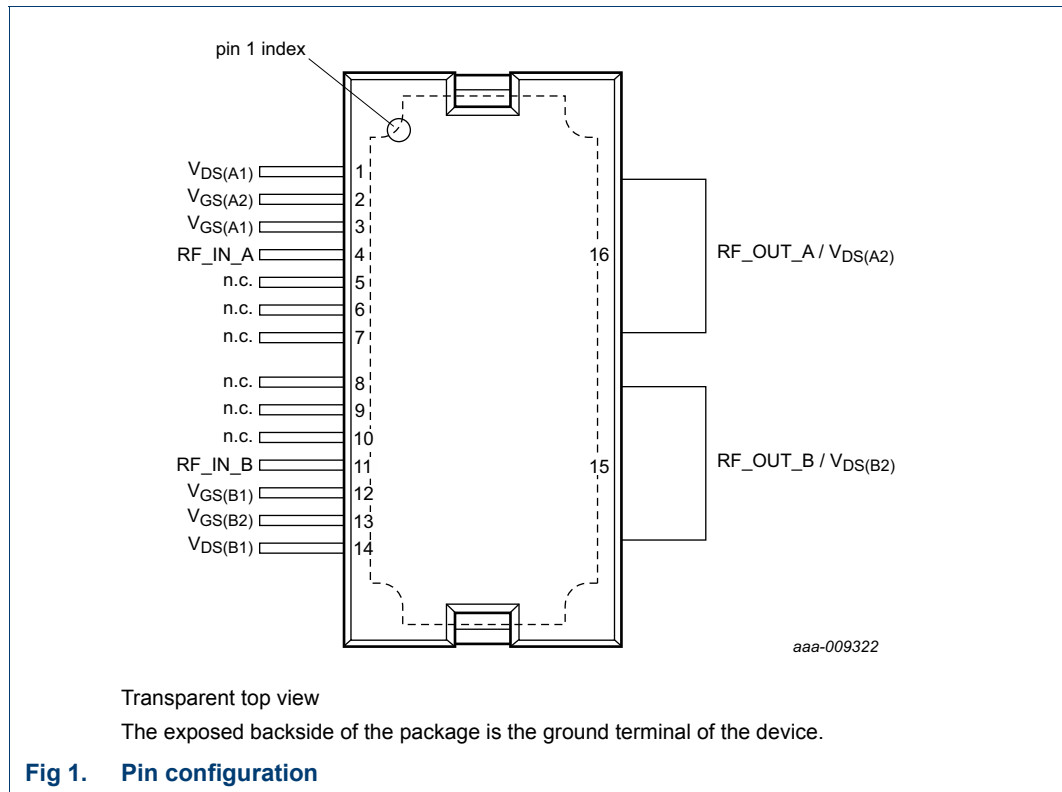
- Designed for broadband operation (frequency 700 MHz to 1000 MHz)
- High section-to-section isolation enabling multiple combinations
- Integrated temperature compensated bias
- Biasing of individual stages is externally accessible
- Integrated ESD protection
- Excellent thermal stability
- High power 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 700 MHz to 1000 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



2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$V_{DS(A1)}$	1	drain-source voltage of section A, driver stage (A1)
$V_{GS(A2)}$	2	gate-source voltage of section A, final stage (A2)
$V_{GS(A1)}$	3	gate-source voltage of section A, driver 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 section B, driver stage (B1)
$V_{GS(B2)}$	13	gate-source voltage of section B, final stage (B2)
$V_{DS(B1)}$	14	drain-source voltage of section B, driver stage (B1)

Table 2. Pin description ...continued

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

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
BLM8G0710S-60PB	HSOP16F	plastic, heatsink small outline package; 16 leads (flat)	SOT1211-2
BLM8G0710S-60PBG	HSOP16	plastic, heatsink small outline package; 16 leads	SOT1212-2

4. Block diagram

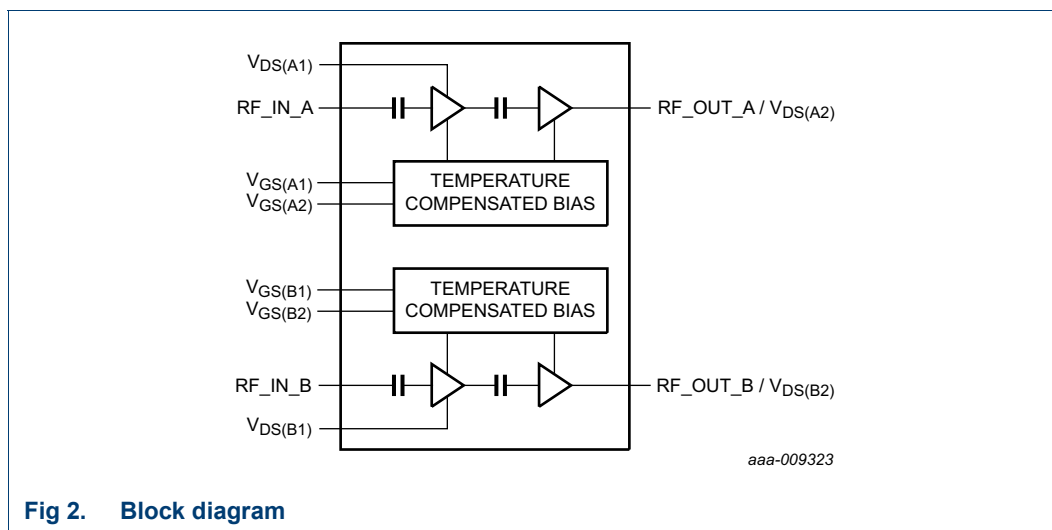


Fig 2. Block diagram

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.

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 = 5 W	[1]	0.9	K/W
		driver stage; T _{case} = 90 °C; P _L = 5 W	[1]	3.7	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 = 482 μA	65	-	-	V	
V _{GSq}	gate-source quiescent voltage	V _{DS} = 28 V; I _D = 240 mA	1.5	2	2.7	V	
		V _{DS} = 28 V; I _D = 240 mA	[1]	1.7	2.65	3.6	V
ΔI _{Dq} /ΔT	quiescent drain current variation with temperature	-40 °C ≤ T _{case} ≤ +85 °C	[1]	-	1	-	%
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	-	8.3	-	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 = 120.6 μA	65	-	-	V	
V _{GSq}	gate-source quiescent voltage	V _{DS} = 28 V; I _D = 60 mA	1.5	2	2.7	V	
		V _{DS} = 28 V; I _D = 60 mA	[2]	1.7	2.65	3.6	V
ΔI _{Dq} /ΔT	quiescent drain current variation with temperature	-40 °C ≤ T _{case} ≤ +85 °C	[2]	-	1	-	%
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	-	2.1	-	A	
I _{GSS}	gate leakage current	V _{GS} = 1.0 V; V _{DS} = 0 V	-	-	140	nA	

[1] In production circuit with 1.3 kΩ gate feed resistor.

[2] In production circuit with 1.2 kΩ gate feed resistor.

Table 7. RF Characteristics
Typical RF performance at T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq1} = 60 mA (driver stage); I_{Dq2} = 240 mA (final stage); P_{L(AV)} = 6 W; unless otherwise specified, measured in an Ampleon wideband straight lead production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: single carrier W-CDMA [1]						
G _p	power gain	f = 730.5 MHz	-	35.6	-	dB
		f = 957.5 MHz	33.2	34.7	36.2	dB
η _D	drain efficiency	f = 730.5 MHz	-	23.4	-	%
		f = 957.5 MHz	21	26	-	%

Table 7. RF Characteristics ...continued

Typical RF performance at $T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$ (driver stage); $I_{Dq2} = 240\text{ mA}$ (final stage); $P_{L(AV)} = 6\text{ W}$; unless otherwise specified, measured in an Ampleon wideband straight lead production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
RL_{in}	input return loss	$f = 957.5\text{ MHz}$	-	-17	-10	dB
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	$f = 730.5\text{ MHz}$	-	-39.5	-	dBc
		$f = 957.5\text{ MHz}$	-	-40	-34.5	dBc
PAR_O	output peak-to-average ratio	$f = 730.5\text{ MHz}$	-	8	-	dB
		$f = 957.5\text{ MHz}$	6.7	8	-	dB
Test signal: CW [2]						
$\Delta\phi_{s21}$	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 = 9.9 dB at 0.01% probability on CCDF.

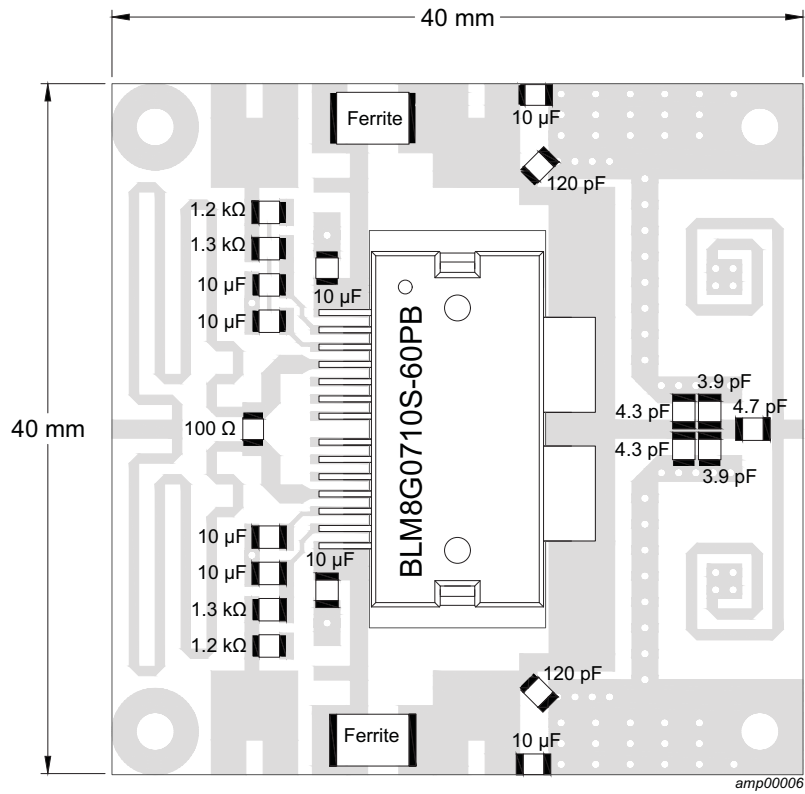
[2] $f = 957.5\text{ MHz}$.

8. Application information

Table 8. Typical performance

Test signal: 1-tone pulsed CW; RF performance at $T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{Dq} = 600\text{ mA}$ unless otherwise specified, measured in an Ampleon wideband $f = 700\text{ MHz}$ to 1000 MHz class AB application circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(1dB)}$	output power at 1 dB gain compression	$f = 800\text{ MHz}$	-	74	-	W
η_D	drain efficiency	at $P_{L(1dB)}$; $f = 800\text{ MHz}$	-	58.4	-	%
G_p	power gain	$P_{L(AV)} = 11.2\text{ W}$; $f = 800\text{ MHz}$	-	36.5	-	dB
B_{video}	video bandwidth	2-tone CW; $P_{L(AV)} = 40\text{ W}$; $f = 881.5\text{ MHz}$	-	154	-	MHz
G_{flat}	gain flatness	$P_{L(AV)} = 11.2\text{ W}$; $f = 700\text{ MHz}$ to 1000 MHz	-	0.3	-	dB
$\Delta G/\Delta T$	gain variation with temperature	$f = 800\text{ MHz}$	-	0.03	-	dB/°C
$ s_{12} ^2$	isolation	between sections A and B; $P_{L(AV)} = 8\text{ W}$; $f = 800\text{ MHz}$	-	24.5	-	dB
K	Rollett stability factor	$T = -40\text{ °C}$; $f = 0.1\text{ GHz}$ to 3 GHz	-	>1.2	-	



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

Fig 3. Component layout for class-AB application circuit

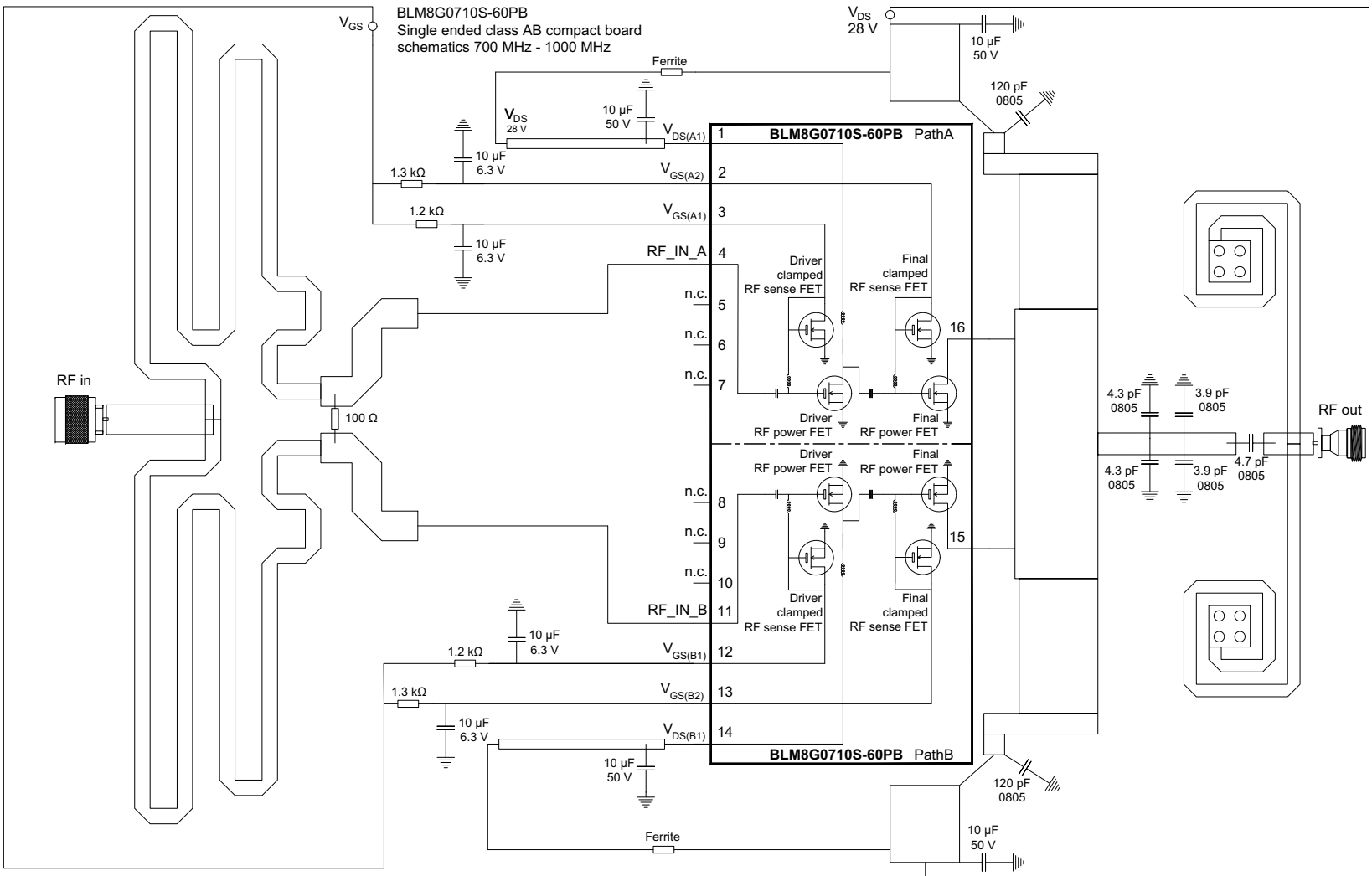


Fig 4. Electrical schematic

8.1 Possible circuit topologies

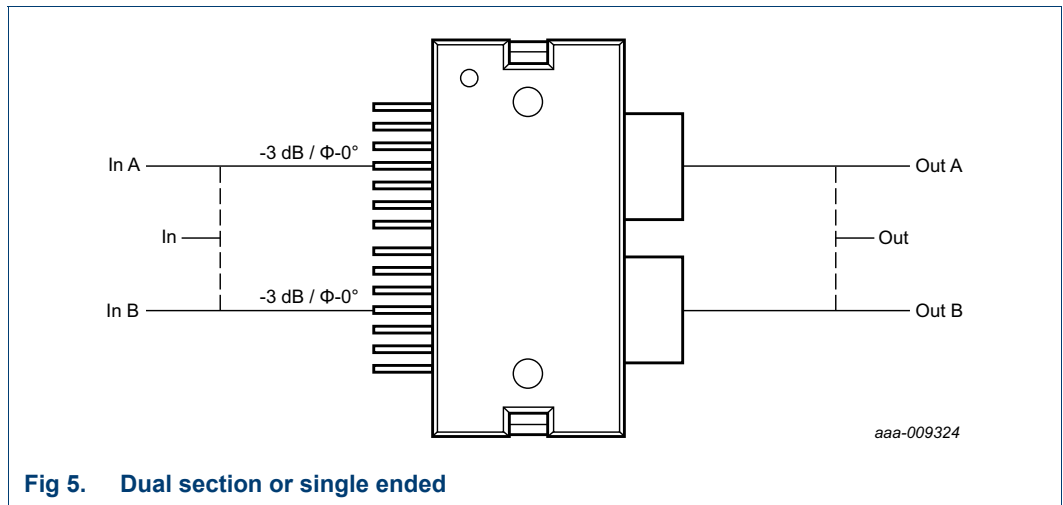


Fig 5. Dual section or single ended

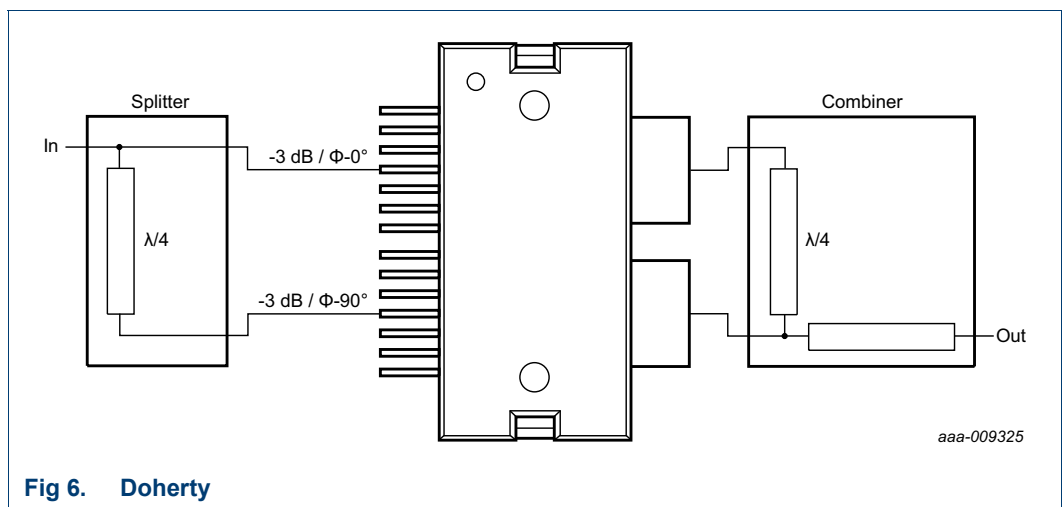


Fig 6. Doherty

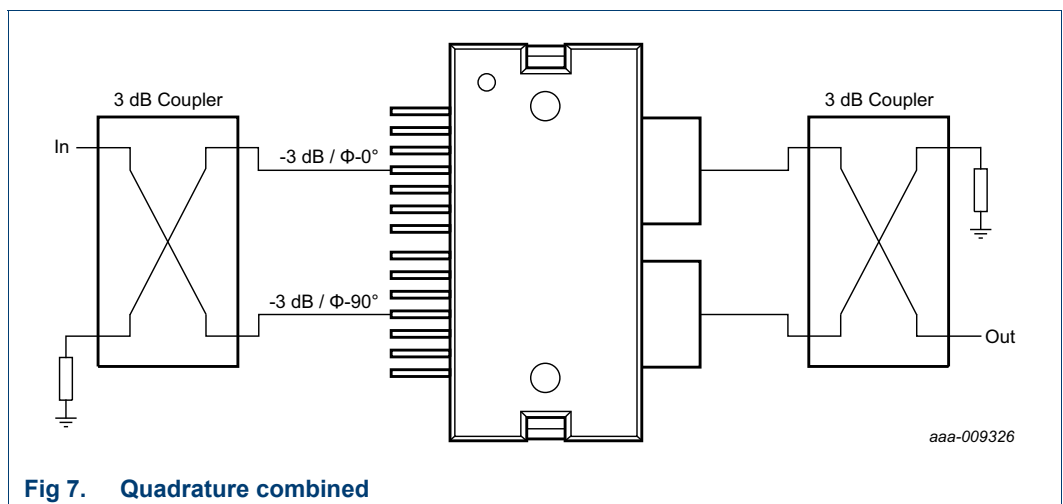
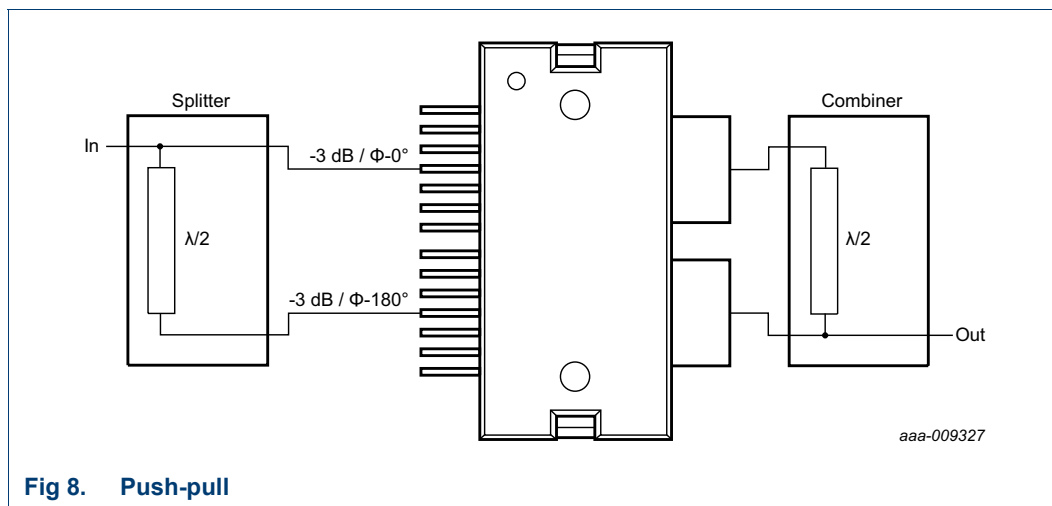


Fig 7. Quadrature combined



8.2 Ruggedness in class-AB operation

The BLM8G0710S-60PB and BLM8G0710S-60PBG are capable of withstanding a load mismatch corresponding to VSWR = 30 : 1 through all phases under the following conditions: $V_{DS} = 32\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 192\text{ mA}$; $P_1 = 13\text{ dBm}$, P_1 is measured at CW and corresponding to $P_{L(3dB)}$ under $Z_S = 50\ \Omega$; $f = 840\text{ MHz}$.

8.3 Impedance information

Table 9. Typical impedance tuned for maximum output power

Measured load-pull data per section; test signal: pulsed CW; $T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 240\text{ mA}$; $t_p = 100\ \mu\text{s}$; $\delta = 10\%$; $Z_S = 50\ \Omega$. Typical values unless otherwise specified.

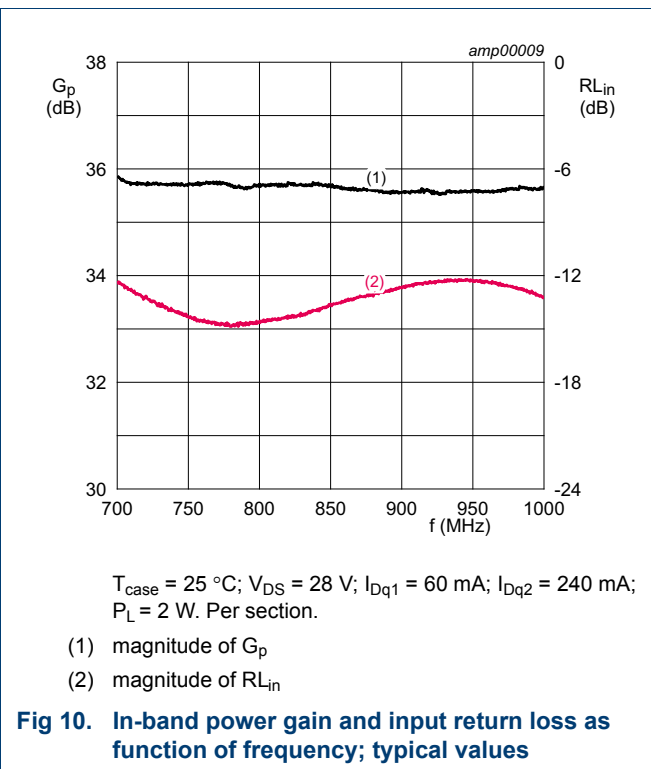
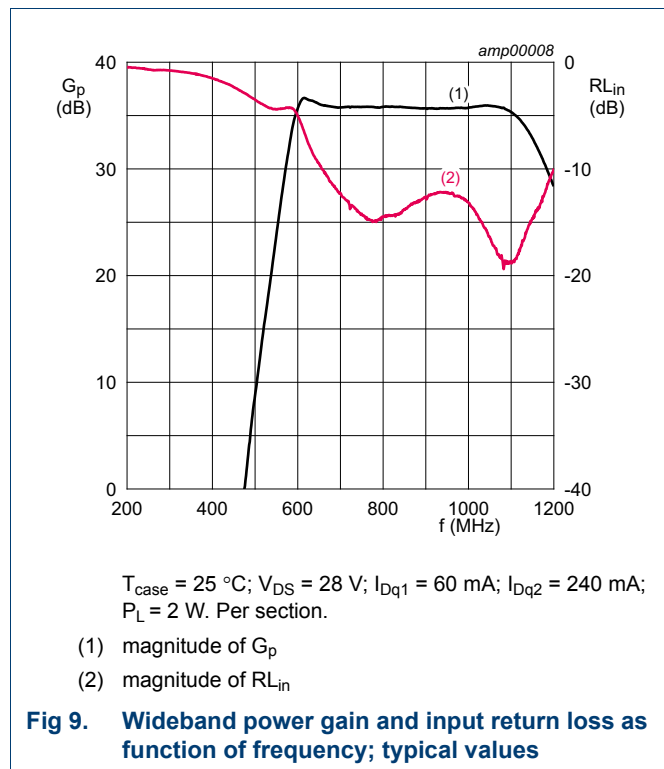
f (MHz)	tuned for maximum output power					tuned for maximum power added efficiency				
	Z_L (Ω)	$G_{p(max)}$ (dB)	P_L (W)	η_{add} (%)	AM-PM conversion (deg)	Z_L (Ω)	$G_{p(max)}$ (dB)	P_L (W)	η_{add} (%)	AM-PM conversion (deg)
BLM8G0710S-60PB										
700	3.0 + j2.1	36.1	47.2	55.1	2.4	4.2 + j5.2	37.6	45.3	65.7	-1.5
720	3.0 + j1.7	35.9	47.3	53.4	2.5	4.4 + j5.0	37.8	45.4	64.6	-1.0
740	3.0 + j1.7	35.8	47.4	54.8	3.0	4.2 + j4.5	37.5	45.7	64.7	-0.2
760	3.0 + j1.3	35.4	47.4	53.5	3.0	4.1 + j4.8	37.2	45.4	64.3	-0.9
780	3.3 + j1.3	35.3	47.5	55.0	2.4	4.0 + j4.4	37.0	45.7	63.7	-1.3
800	3.2 + j0.9	35.2	47.5	53.8	3.1	3.9 + j4.2	37.0	45.8	64.0	-1.0
820	3.3 + j1.0	35.0	47.5	54.9	2.4	4.1 + j3.8	36.7	46.0	63.6	-0.1
840	3.4 + j0.5	34.8	47.5	53.2	2.3	3.8 + j4.0	36.8	45.7	63.4	-1.3
860	3.5 + j0.5	34.7	47.5	53.8	2.1	3.8 + j3.8	36.7	45.7	63.1	-1.2
880	3.4 + j0.4	34.8	47.4	53.2	1.8	4.0 + j3.5	36.7	45.9	63.1	-0.3
900	3.4 + j0.3	34.7	47.4	53.4	2.1	3.7 + j3.6	36.8	45.7	63.0	-0.9
920	3.4 + j0.4	34.7	47.4	54.4	1.4	3.8 + j3.7	36.8	45.5	63.0	-0.5
940	3.5 + j0.0	34.5	47.3	52.9	1.1	3.5 + j3.2	36.6	45.7	62.3	-0.5
960	3.5 - j0.1	34.2	47.3	52.7	1.3	3.5 + j3.1	36.4	45.7	62.0	-0.3
980	3.5 - j0.1	34.2	47.3	53.9	0.4	3.4 + j2.8	36.2	45.8	62.2	-1.0

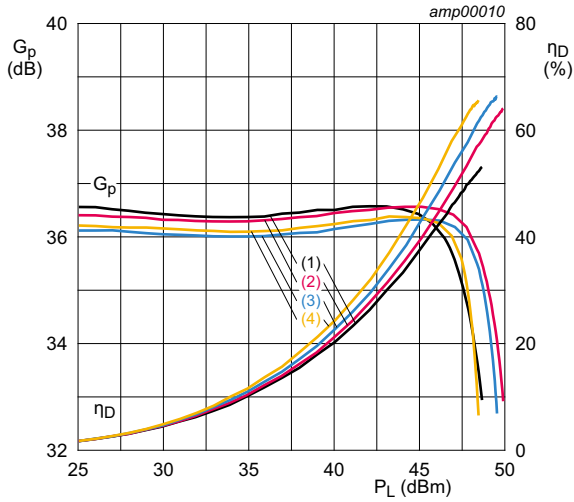
Table 9. Typical impedance tuned for maximum output power ...continued

Measured load-pull data per section; test signal: pulsed CW; $T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 240\text{ mA}$; $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$; $Z_S = 50\text{ }\Omega$. 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)
BLM8G0710S-60PBG										
700	3.0 + j0.6	36.3	47.5	55.1	0.3	4.5 + j3.6	37.7	45.8	66.1	-3.2
720	3.0 + j0.6	36.4	47.5	55.6	0.6	4.4 + j3.1	37.7	46.1	65.7	-2.2
740	2.9 + j0.3	35.9	47.6	54.6	1.9	4.1 + j3.4	37.3	45.8	65.4	-2.0
760	3.0 + j0.2	35.6	47.7	56.0	0.6	4.4 + j2.8	37.0	46.1	65.1	-2.2
780	3.3 - j0.1	35.5	47.7	55.9	0.9	4.3 + j2.9	37.0	46.0	64.7	-2.9
800	3.3 - j0.5	35.4	47.7	54.4	0.8	3.9 + j2.6	37.0	46.1	64.4	-3.2
820	3.3 - j0.5	35.8	47.7	55.2	1.3	4.1 + j2.3	37.3	46.2	64.0	-1.8
840	3.3 - j0.5	35.5	47.6	55.4	1.3	4.1 + j2.1	36.6	46.3	63.7	-1.3
860	3.5 - j0.9	34.5	47.7	54.9	0.6	3.8 + j2.0	35.9	46.3	63.7	-2.5
880	3.4 - j1.0	34.7	47.6	54.2	-0.1	3.6 + j2.0	36.4	46.1	63.1	-3.2
900	3.4 - j1.2	34.8	47.6	54.2	0.0	3.7 + j1.8	36.5	46.1	63.3	-2.7
920	3.4 - j1.1	35	47.6	55.4	-0.4	3.7 + j1.8	36.6	45.9	63.2	-1.9
940	3.5 - j1.4	34.7	47.5	54.7	-0.3	3.8 + j1.6	36.4	46.0	62.8	-1.2
960	3.5 - j1.6	34.4	47.5	54.9	-0.4	3.5 + j1.3	36.1	46.0	62.8	-2.2

8.4 Graphs

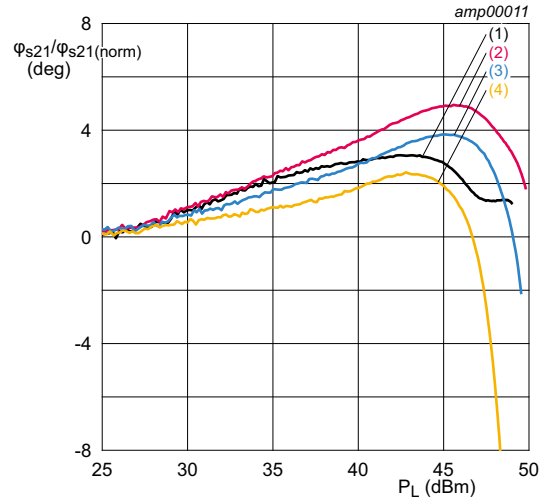




$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 240\text{ mA}$. Per section.

- (1) $f = 700\text{ MHz}$
- (2) $f = 800\text{ MHz}$
- (3) $f = 900\text{ MHz}$
- (4) $f = 1000\text{ MHz}$

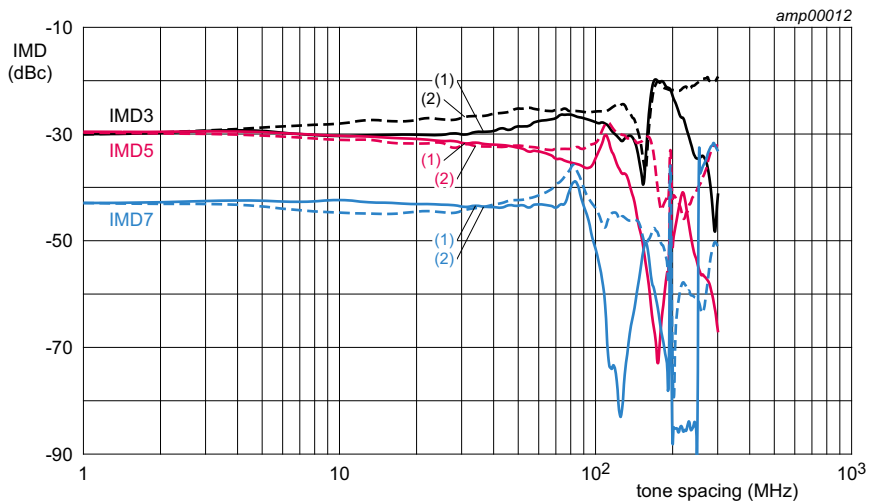
Fig 11. Power gain and drain efficiency as function of output power; typical values



Normalized at $P_L = 22\text{ dBm}$; $T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 240\text{ mA}$. Per section.

- (1) $f = 700\text{ MHz}$
- (2) $f = 800\text{ MHz}$
- (3) $f = 900\text{ MHz}$
- (4) $f = 1000\text{ MHz}$

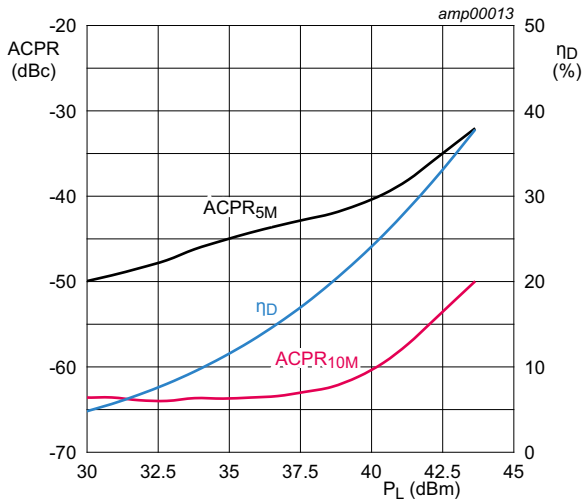
Fig 12. Normalized phase response as a function of output power; typical values



$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 240\text{ mA}$; $f = 881.5\text{ MHz}$; 2-tone CW, $P_L = 20\text{ W}$. Per section.

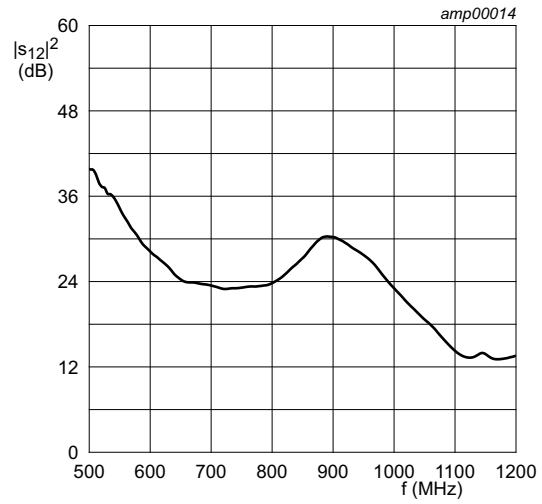
- (1) IMD low
- (2) IMD high

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



$T_{case} = 25\text{ }^\circ\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 60\text{ mA}$; $I_{Dq2} = 240\text{ mA}$;
 $f = 900\text{ MHz}$; 1-carrier W-CDMA; test model 1;
 $PAR = 9.9\text{ dB}$ at 0.01% probability on CCDF. Per section

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



$T_{case} = 25\text{ }^\circ\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} = 40\text{ mA}$; $I_{Dq2} = 260\text{ mA}$,
 measured on evaluation board.

Fig 15. Section A to B isolation as a function of frequency; typical values

9. Package outline

HSOP16F: plastic, heatsink small outline package; 16 leads(flat)

SOT1211-2

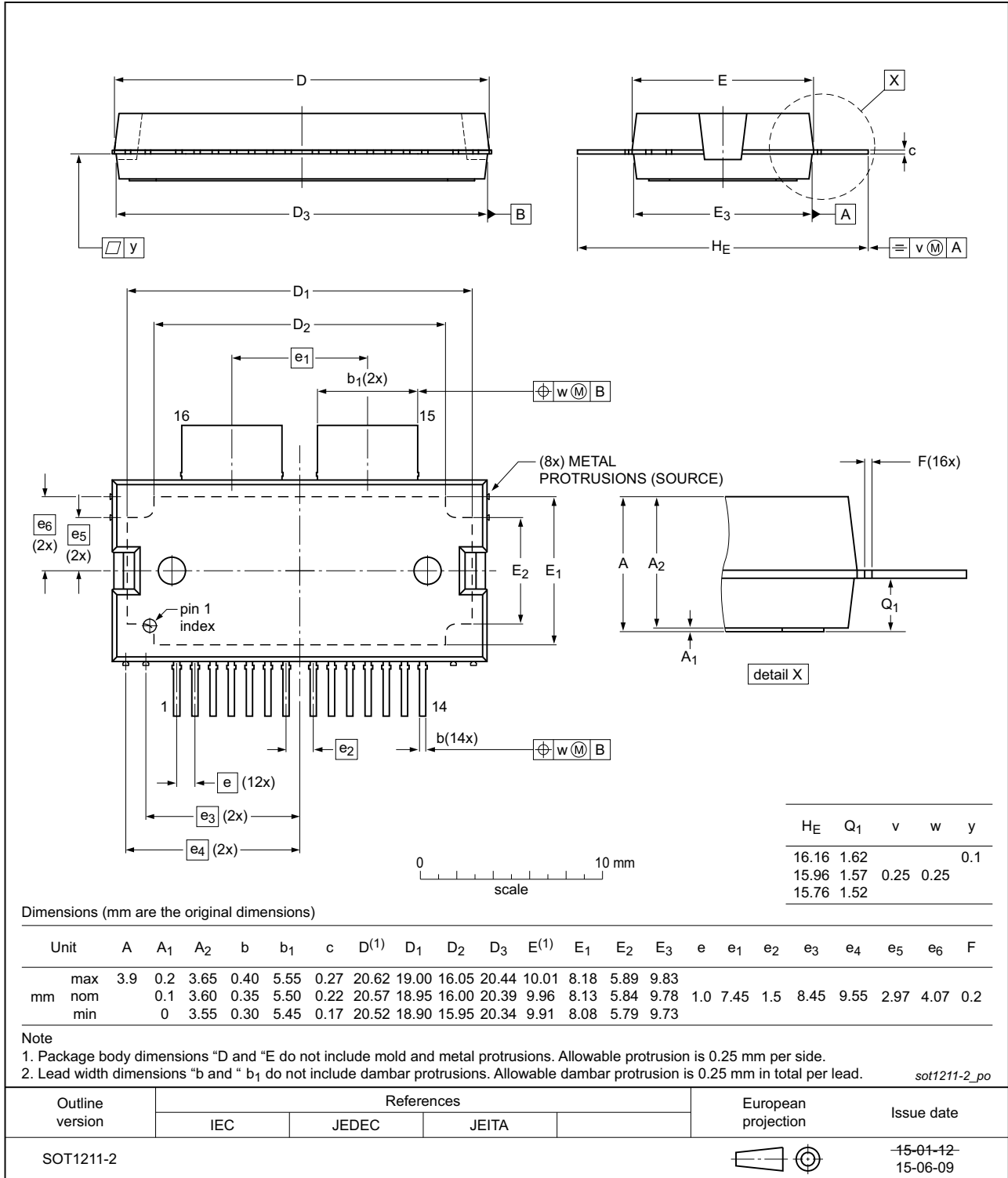


Fig 16. Package outline SOT1211-2 (HSOP16F)

HSOP16: plastic, heatsink small outline package; 16 leads

SOT1212-2

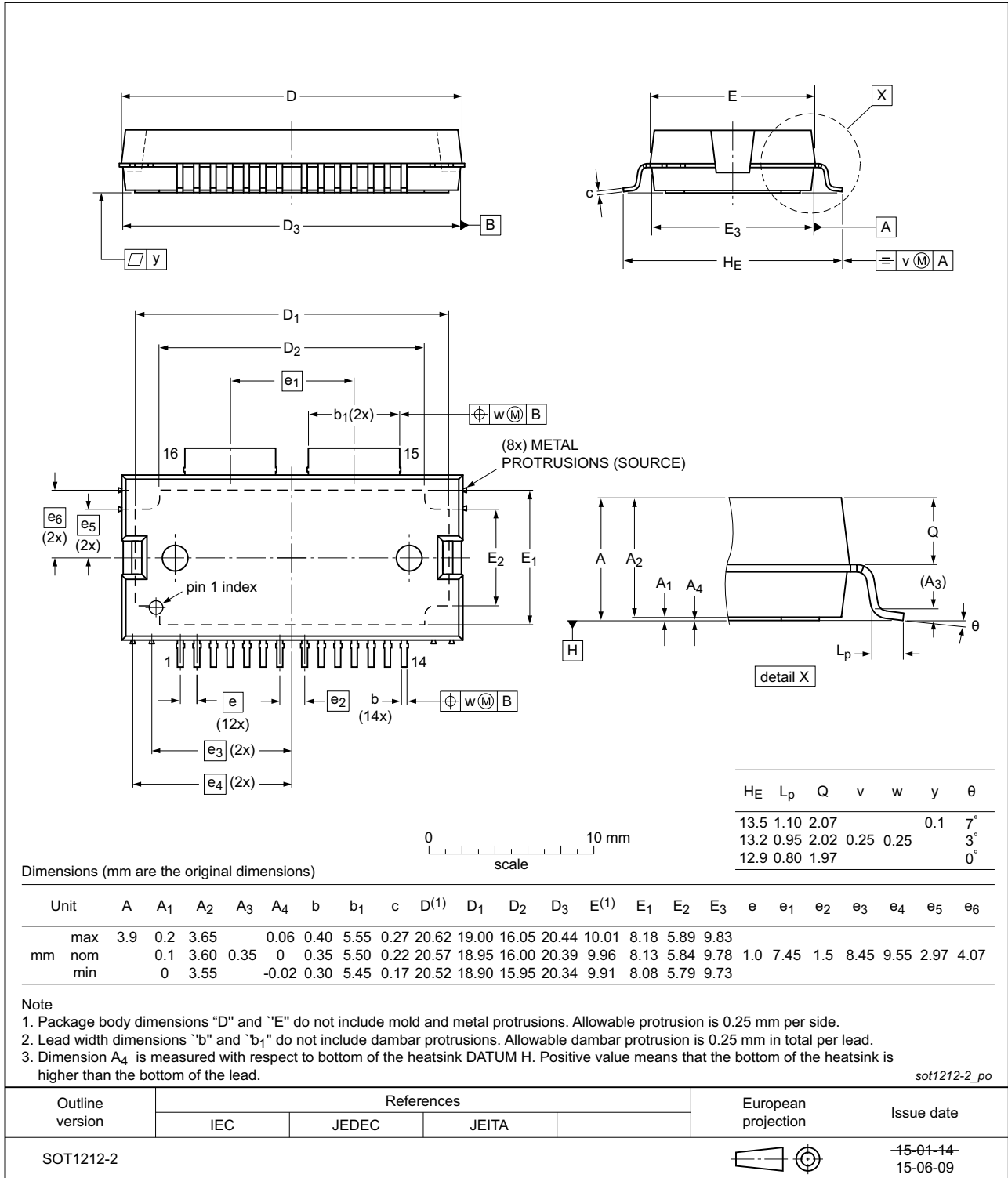


Fig 17. Package outline SOT1212-2 (HSOP16)

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
GEN8	Eighth 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
BLM8G0710S-60PB_S-60PBG v.2	20160322	Product data sheet	-	BLM8G0710S-60PB_S-60PBG v.1
Modifications:	<ul style="list-style-type: none"> Figure 16 on page 13: figure updated Figure 17 on page 14: figure updated 			
BLM8G0710S-60PB_S-60PBG v.1	20160225	Product data sheet	-	-

13. Legal information

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.ampleon.com>.

13.2 Definitions

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