BLM9D3438-16AM

LDMOS 3-stage integrated Doherty MMIC

AMPLEON

Rev. 1 — 2 November 2021 Product data sheet

1. Product profile

1.1 General description

The BLM9D3438-16AM is a 3-stage 16 W fully integrated Doherty MMIC solution using Ampleon's state of the art GEN9 LDMOS technology. The carrier and peaking device, input splitter and output combiner are integrated in a single package. This multiband device is perfectly suited as a device in the frequency range from 3400 MHz to 3800 MHz. Available in LGA outline.

Table 1. Performance

Typical RF performance at T_{case} = 25 °C; I_{Dq} = 38 mA (driver and final stages) in a demo circuit; $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.55$ V.

Test signal	f	V_{DS}	$P_{L(AV)}$	G_p	η_D	$ACPR_{5M}$
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)
single carrier W-CDMA [1]	3600	28	0.8	32.5	24.3	−33.8

[1] Test signal: 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability on CCDF.

1.2 Features and benefits

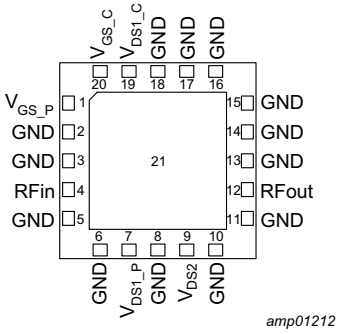
- Integrated input splitter
- Integrated output combiner
- Very high efficiency
- Designed for broadband operation (frequency 3400 MHz to 3800 MHz)
- Independent control of carrier and peaking bias
- Integrated ESD protection
- Excellent thermal stability
- High power gain, input and output matched to impedance 50 Ω
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- RF power MMIC for multi-carrier and multi-standard GSM, W-CDMA, LTE and NR small cell base stations in the 3400 MHz to 3800 MHz frequency range

2. Pinning information

2.1 Pinning



Transparent top view

The exposed backside of the package is the ground terminal of the device.
RFout is DC grounded.

Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
V_{GS_P}	1	gate-source voltage of peaking
GND	2	ground
GND	3	ground
RFin	4	RF input
GND	5	ground
GND	6	ground
V_{DS1_P}	7	drain-source voltage of peaking driver
GND	8	ground
V_{DS2}	9	drain-source voltage of final stages
GND	10	ground
GND	11	ground
RFout	12	RF output
GND	13	ground
GND	14	ground
GND	15	ground
GND	16	ground
GND	17	ground
GND	18	ground

Table 2. Pin description *…continued*

Symbol	Pin	Description
V_{DS1_C}	19	drain-source voltage of carrier driver
V_{GS_C}	20	gate-source voltage of carrier driver
GND	21	RF ground

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLM9D3438-16AM	-	plastic thermal enhanced package; no leads; 20 terminals; body 7.0 x 7.0 x 0.98 mm	LGA-7x7-20-2

4. Block diagram

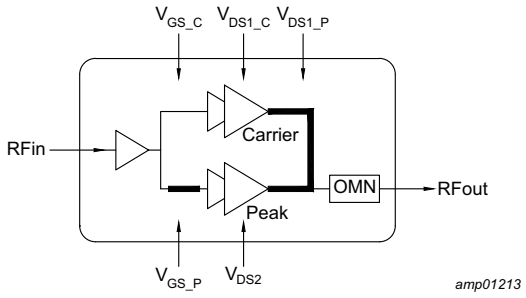


Fig 2. Block diagram

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		–6	+11	V
T_{stg}	storage temperature		–55	+125	°C
T_j	junction temperature	[1]	-	175	°C
T_{case}	case temperature	[1]	-	125	°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	T_{case} = 80 °C; $P_{L(AV)}$ = 0.8 W	[1]	10.8	K/W

[1] When operated with a 1-carrier W-CDMA with PAR = 7.2 dB.

7. Characteristics

Table 6. DC characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Carrier						
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 38 mA	1.65	2.1	2.75	V
I_{GSS}	gate leakage current	V_{GS} = +11 V/–5 V; V_{DS} = 0 V	-	-	140	nA
Peaking						
I_{GSS}	gate leakage current	V_{GS} = +11 V/–5 V; V_{DS} = 0 V	-	-	140	nA
Final stages						
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 60 V	-	-	1.4	µA
Driver stages						
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 60 V	-	-	1.4	µA

Table 7. RF Characteristics

Typical RF performance at T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 38 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.55$ V; P_L = 0.8 W; f = 3.8 GHz. Unless otherwise specified, measured in an Ampleon production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: CW pulsed						
G_p	power gain		25	29.5	-	dB
η_D	drain efficiency		14	19	-	%
RL_{in}	input return loss		-	–12	–8	dB
$P_{L(3dB)}$	output power at 3 dB gain compression		41	42	-	dBm

8. Application information

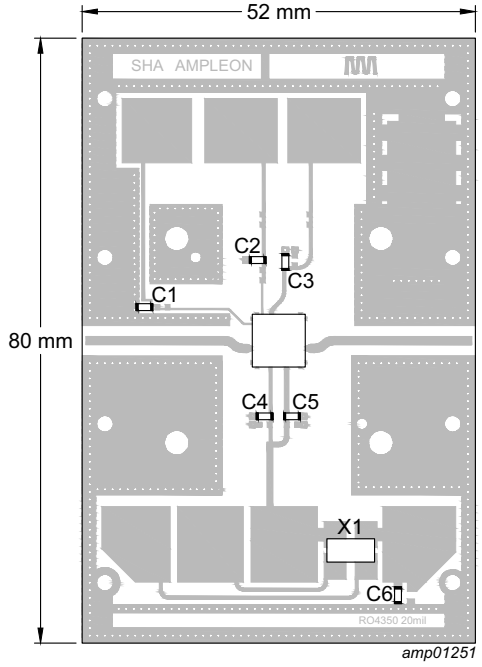
Table 8. Typical performance

Test signal: 1-carrier W-CDMA;T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 38 mA (driver and final stages); test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability CCDF; unless otherwise specified, measured in an Ampleon 3400 MHz to 3800 MHz frequency band demo circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(3dB)}$	output power at 3 dB gain compression	f = 3600 MHz [1]	-	42	-	dBm
η_D	drain efficiency	13 dB OBO ($P_{L(AV)}$ = 29 dBm); f = 3600 MHz	-	24.3	-	%
G_p	power gain	$P_{L(AV)}$ = 29 dBm; f = 3600 MHz	-	32.5	-	dB
G_{flat}	gain flatness	$P_{L(AV)}$ = 29 dBm; f = 3400 MHz to 3800 MHz	-	2.5	-	dB
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	$P_{L(AV)}$ = 29 dBm; f = 3600 MHz	-	−33.8	-	dBc
$\Delta G/\Delta T$	gain variation with temperature	f = 3600 MHz	-	0.05	-	dB/°C
K	Rollett stability factor	T_{case} = −40 °C; f = 0.15 GHz to 5 GHz [2]	-	>1	-	

[1] Pulsed CW power sweep measurement (δ = 10 %, t_p = 100 μs).

[2] S-parameters measured in a demo circuit.



Printed-Circuit Board (PCB): Rogers 4350B; ε_r = 3.66; thickness = 0.508 mm; thickness of copper plating = 35 μm.

Fig 3. Component layout

Table 9. Demo test circuit list of components

See Figure 3 for component layout.

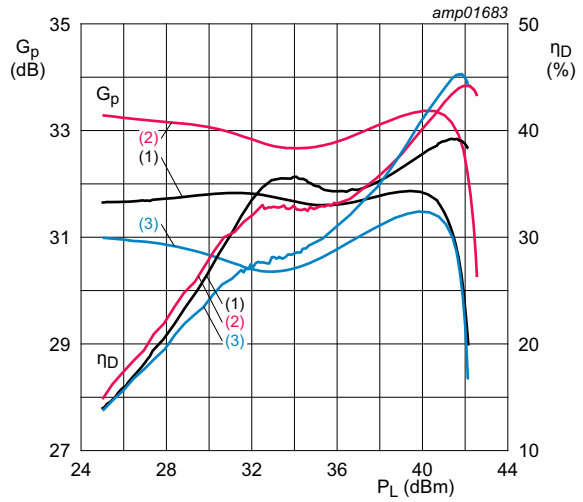
Component	Description	Value	Remarks
C1, C2, C3, C4, C5	multilayer ceramic chip capacitor	1 μF [1]	
C6	multilayer ceramic chip capacitor	1 μF [1]	
X1	current sense resistor	100 mΩ, 1 W	Y44870R10000B0R

[1] Murata or capacitor of same quality.

8.1 Ruggedness in a Doherty operation

The BLM9D3438-16AM is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 28 V; I_{Dq} = 38 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.55$ V; P_i corresponding to P_L = 42 dBm under Z_S = 50 Ω load; f = 3400 MHz (CW pulsed); T_{case} = 25 °C.

8.2 Graphs



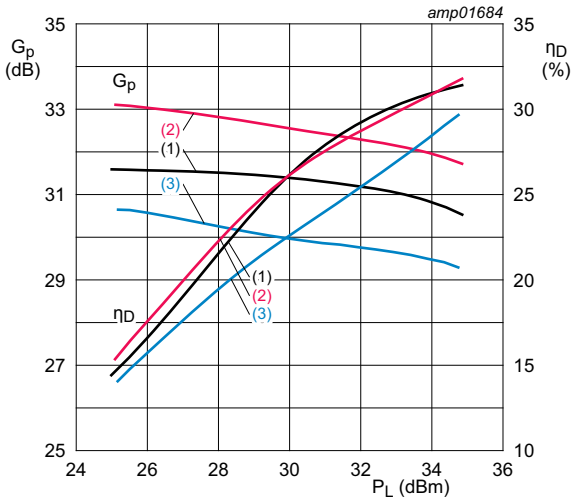
V_{DS} = 28 V; I_{Dq} = 38 mA; $V_{GS(amp)peak}$ = 1.59 V; t_p = 100 μs; δ = 10 %.

(1) f = 3400 MHz

(2) f = 3600 MHz

(3) f = 3800 MHz

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



V_{DS} = 28 V; I_{Dq} = 38 mA; $V_{GS(amp)peak}$ = 1.59 V

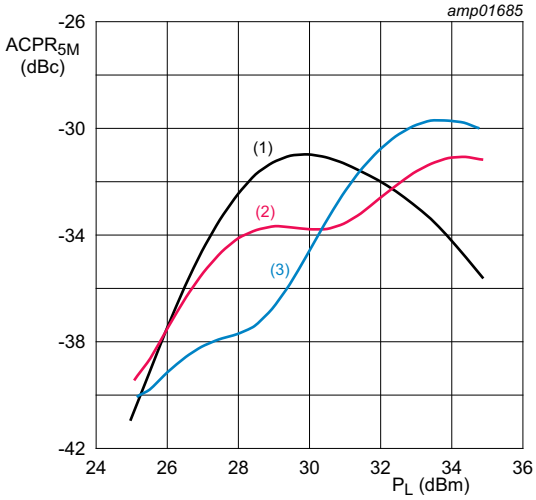
Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability on CCDF.

(1) f = 3400 MHz

(2) f = 3600 MHz

(3) f = 3800 MHz

Fig 5. Power gain and drain efficiency as function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 38 mA; $V_{GS(amp)peak}$ = 1.59 V

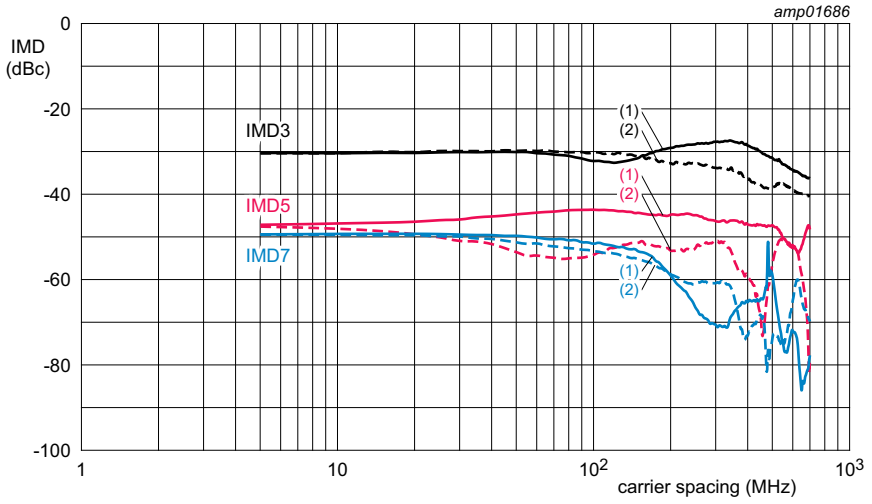
Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability on CCDF.

(1) f = 3400 MHz

(2) f = 3600 MHz

(3) f = 3800 MHz

Fig 6. Adjacent channel power ratio as a function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 38 mA; $V_{GS(amp)peak}$ = 1.59 V; f = 3600 MHz.

Test signal: 2-carrier CW; P_L at 0.8 W.

(1) IMD low

(2) IMD high

Fig 7. VBW capability

9. Package outline

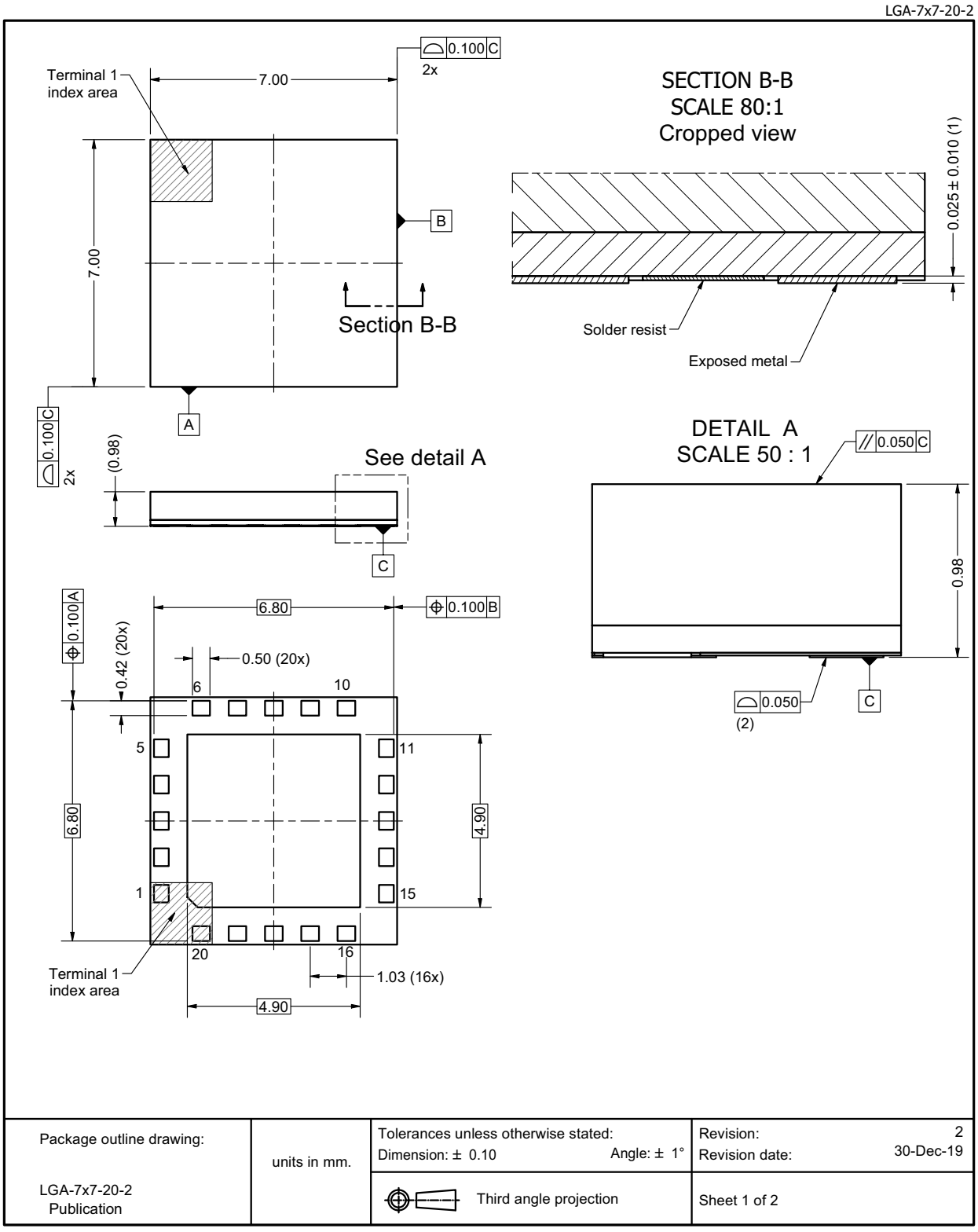


Fig 8. Package outline LGA-7x7-20-2 (sheet 1 of 2)

LGA-7x7-20-2

Drawing Notes	
Item	Description
1	Metal thickness of solder pads.
2	Flatness with respect to exposed metal

Package outline drawing: LGA-7x7-20-2	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.10 Angle: ± 1° Third angle projection	Revision: 2 Revision date: 30-Dec-19 Sheet 2 of 2

Fig 9. Package outline LGA-7x7-20-2 (sheet 2 of 2)

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.

Table 10. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C1 [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1B [2]

[1] CDM classification C1 is granted to any part that passes after exposure to an ESD pulse of 250 V.

[2] HBM classification 1B is granted to any part that passes after exposure to an ESD pulse of 500 V.

11. Abbreviations

Table 11. Abbreviations

Acronym	Description
3GPP	3rd Generation Partnership Project
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
DPCH	Dedicated Physical CHannel
ESD	ElectroStatic Discharge
GEN9	Ninth Generation
GSM	Global System for Mobile Communications
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LTE	Long Term Evolution
MMIC	Monolithic Microwave Integrated Circuit
MTF	Median Time to Failure
NR	New Radio
OBO	Output Back Off
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
VBW	Video Bandwidth
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLM9D3438-16AM v.1	20211102	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.

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15. Contents

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