

BLM9D0708-05AM

LDMOS 1-stage integrated Doherty MMIC

Rev. 1 — 4 February 2021

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The BLM9D0708-05AM is a 1-stage 5 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 728 MHz to 821 MHz. Available in LGA outline.

Table 1. Performance

Typical RF performance at $T_{case} = 25\text{ }^{\circ}\text{C}$; $I_{DQ} = 12\text{ mA}$ (driver and final stages) in a demo circuit; $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.55\text{ V}$.

Test signal	f (MHz)	V _{DS} (V)	P _{L(AV)} (W)	G _p (dB)	η _D (%)	ACPR _{5M} (dBc)
single carrier W-CDMA [1]	775	28	0.63	18.5	40	-32.5

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

1.2 Features and benefits

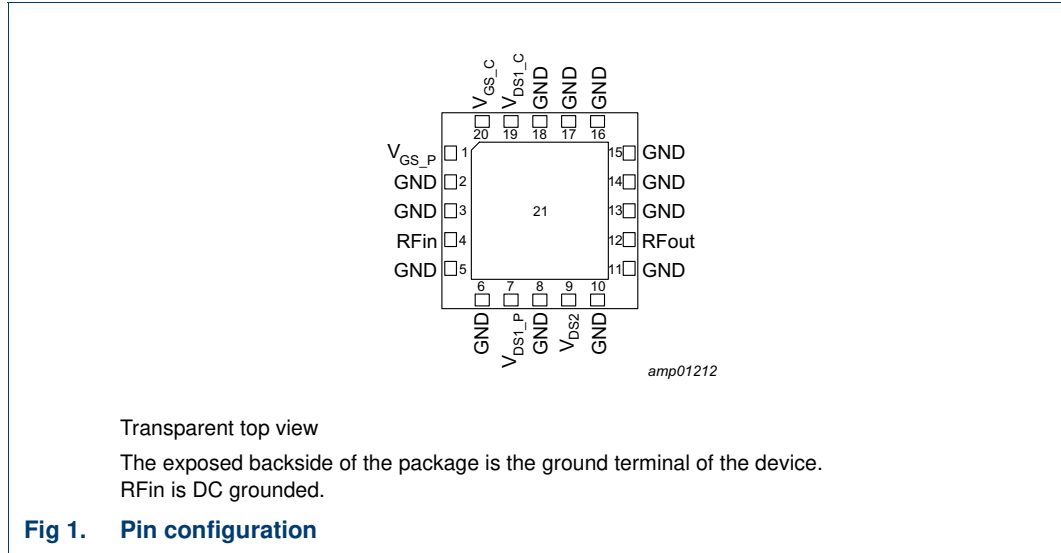
- Integrated input splitter
- Integrated output combiner
- Very high efficiency
- Designed for broadband operation (frequency 728 MHz to 821 MHz)
- Independent control of carrier and peaking bias
- Integrated ESD protection
- Excellent thermal stability
- High power gain, input and output matched to 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 728 MHz to 821 MHz frequency range

2. Pinning information

2.1 Pinning



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		Version
	Name	Description	
BLM9D0708-05AM	-	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

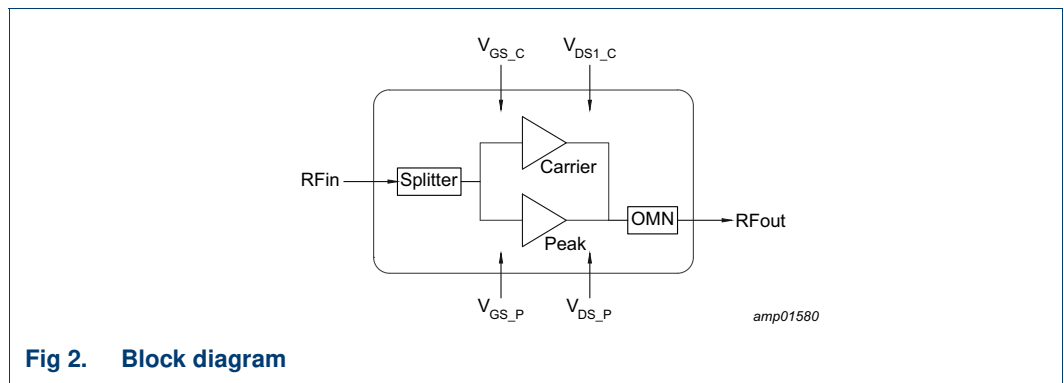


Fig 2. Block diagram

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)} = 0.63 W [1]	8.1	K/W
		T _{case} = 80 °C; P _{L(AV)} = 1 W [1]	6.3	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 = 12 mA	1.65	2.2	2.75	V
I _{GSS}	gate leakage current	V _{GS} = 11 V; V _{DS} = -5 V	-	-	140	nA
Peaking						
I _{GSS}	gate leakage current	V _{GS} = 11 V; V _{DS} = -5 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} = 12 mA (carrier);
V_{GSq(peaking)} = V_{GSq(carrier)} - 0.55 V; P_L = 0.63 W; f = 821 MHz. Unless otherwise specified,
measured in an Ampleon production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: CW pulsed						
G _p	power gain		16.5	17.8	-	dB
η _D	drain efficiency	P _L = 0.63 W	35	39.5	-	%
RL _{in}	input return loss		-	-16	-11	dB
P _{L(3dB)}	output power at 3 dB gain compression		36	37	-	dBm

8. Application information

Table 8. Typical performance

Test signal: 1-carrier W-CDMA; $T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{DQ} = 12\text{ mA}$ (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 728 MHz to 821 MHz frequency band demo circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(3dB)}$	output power at 3 dB gain compression	$f = 728\text{ MHz}$ [1]	-	37	-	dBm
η_D	drain efficiency	9 dB OBO ($P_{L(AV)} = 28\text{ dBm}$); $f = 728\text{ MHz}$	-	41	-	%
G_p	power gain	$P_{L(AV)} = 28\text{ dBm}$; $f = 728\text{ MHz}$	-	18	-	dB
G_{flat}	gain flatness	$P_{L(AV)} = 28\text{ dBm}$; $f = 728\text{ MHz}$ to 821 MHz	-	0.8	-	dB
$ACPR_{5M}$	adjacent channel power ratio (5M)	$P_{L(AV)} = 28\text{ dBm}$; $f = 728\text{ MHz}$	-	-33	-	dBc
$\Delta G/\Delta T$	gain variation with temperature	$f = 728\text{ MHz}$	-	0.02	-	dB/°C
K	Rollett stability factor	$T_{case} = -40\text{ °C}$; $f = 0.15\text{ GHz}$ to 5 GHz [2]	-	>1	-	

[1] Pulsed CW power sweep measurement ($\delta = 10\%$, $t_p = 100\text{ }\mu\text{s}$).

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

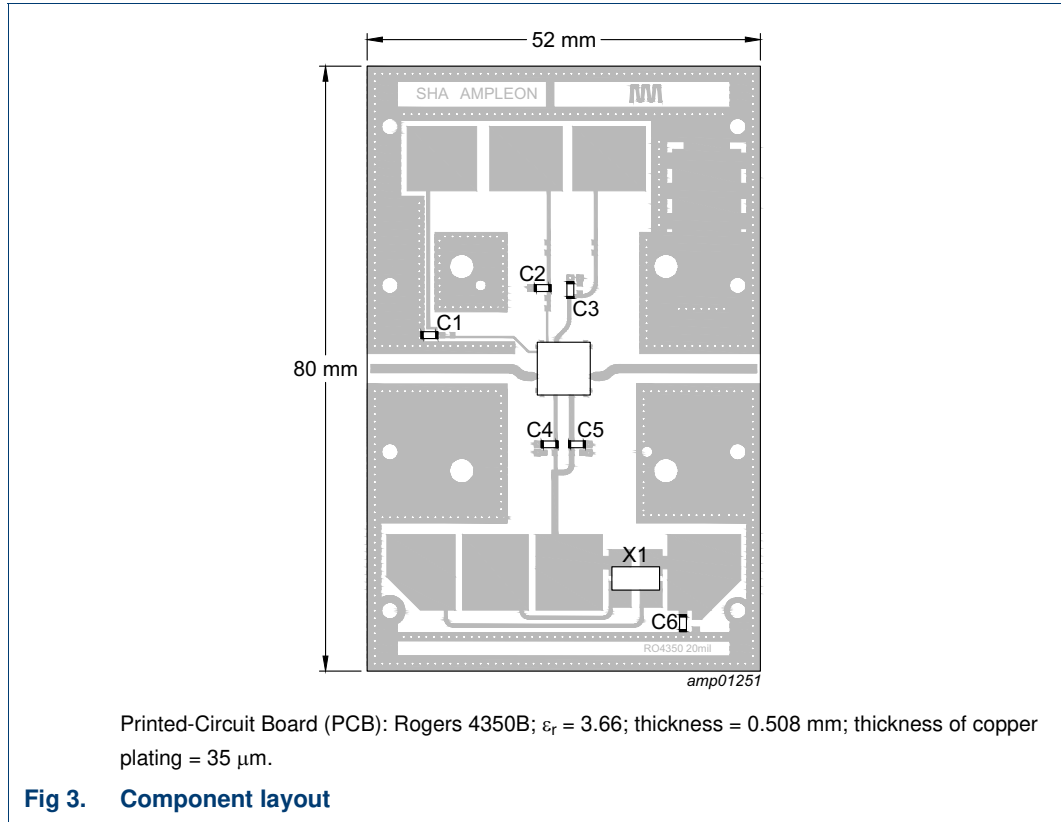


Table 9. Demo test circuit list of components

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	[2]
X1	current sense resistor	100 m Ω , 1 W	Y44870R10000B0R

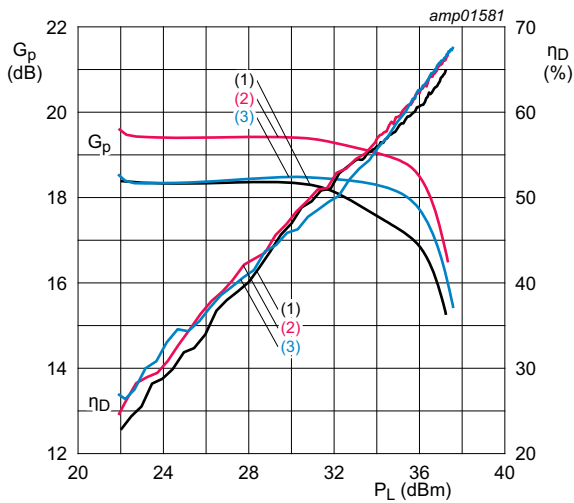
[1] American Technical Ceramics type 600F or capacitor of same quality.

[2] Murata or capacitor of same quality.

8.1 Ruggedness in a Doherty operation

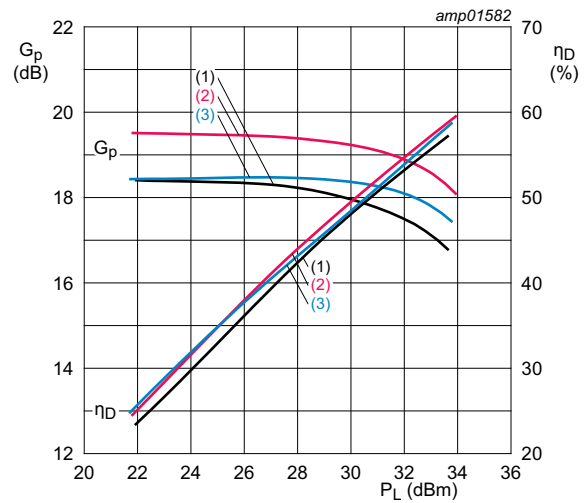
The BLM9D0708-05AM is capable of withstanding a load mismatch corresponding to $V_{\text{SWR}} = 10 : 1$ through all phases under the following conditions: $V_{\text{DS}} = 28 \text{ V}$; $I_{\text{Dq}} = 12 \text{ mA}$ (carrier); $V_{\text{GSq(peak)}} = V_{\text{GSq(carrier)}} - 0.55 \text{ V}$; P_i corresponding to $P_{\text{L}(1\text{dB})}$ under $Z_{\text{S}} = 50 \Omega$ load; $f = 728 \text{ MHz}$ (CW); $T_{\text{case}} = 25 \text{ }^\circ\text{C}$.

8.2 Graphs



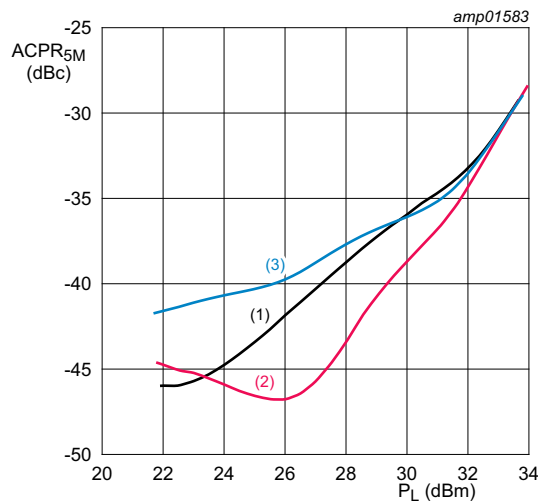
$V_{DS} = 28\text{ V}$; $I_{Dq} = 12\text{ mA}$; $V_{GS(amp)peak} = 1.55\text{ V}$;
 $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$.
 (1) $f = 728\text{ MHz}$
 (2) $f = 774.5\text{ MHz}$
 (3) $f = 821\text{ MHz}$

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



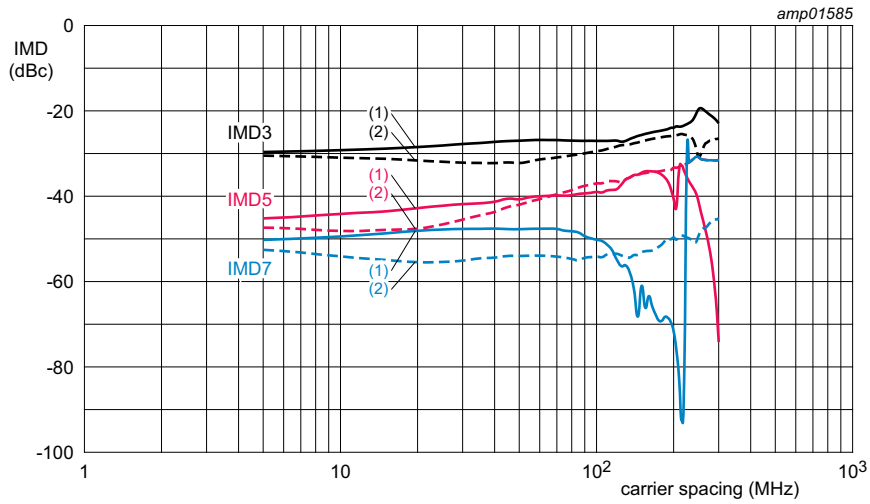
$V_{DS} = 28\text{ V}$; $I_{Dq} = 12\text{ mA}$; $V_{GS(amp)peak} = 1.55\text{ V}$.
 Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability CCDF.
 (1) $f = 728\text{ MHz}$
 (2) $f = 774.5\text{ MHz}$
 (3) $f = 821\text{ MHz}$

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



$V_{DS} = 28\text{ V}$; $I_{Dq} = 12\text{ mA}$; $V_{GS(amp)peak} = 1.55\text{ V}$.
 Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability CCDF.
 (1) $f = 728\text{ MHz}$
 (2) $f = 774.5\text{ MHz}$
 (3) $f = 821\text{ MHz}$

Fig 6. Adjacent channel power ratio (5 MHz) as a function of output power; typical values



$V_{DS} = 28 \text{ V}$; $I_{Dq} = 12 \text{ mA}$; $V_{GS(\text{amp})\text{peak}} = 1.55 \text{ V}$; $f = 774.5 \text{ MHz}$.
 Test signal: 2-carrier pulsed CW; $t_p = 100 \mu\text{s}$; $\delta = 10 \%$.

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

Fig 7. VBW capability

9. Package outline

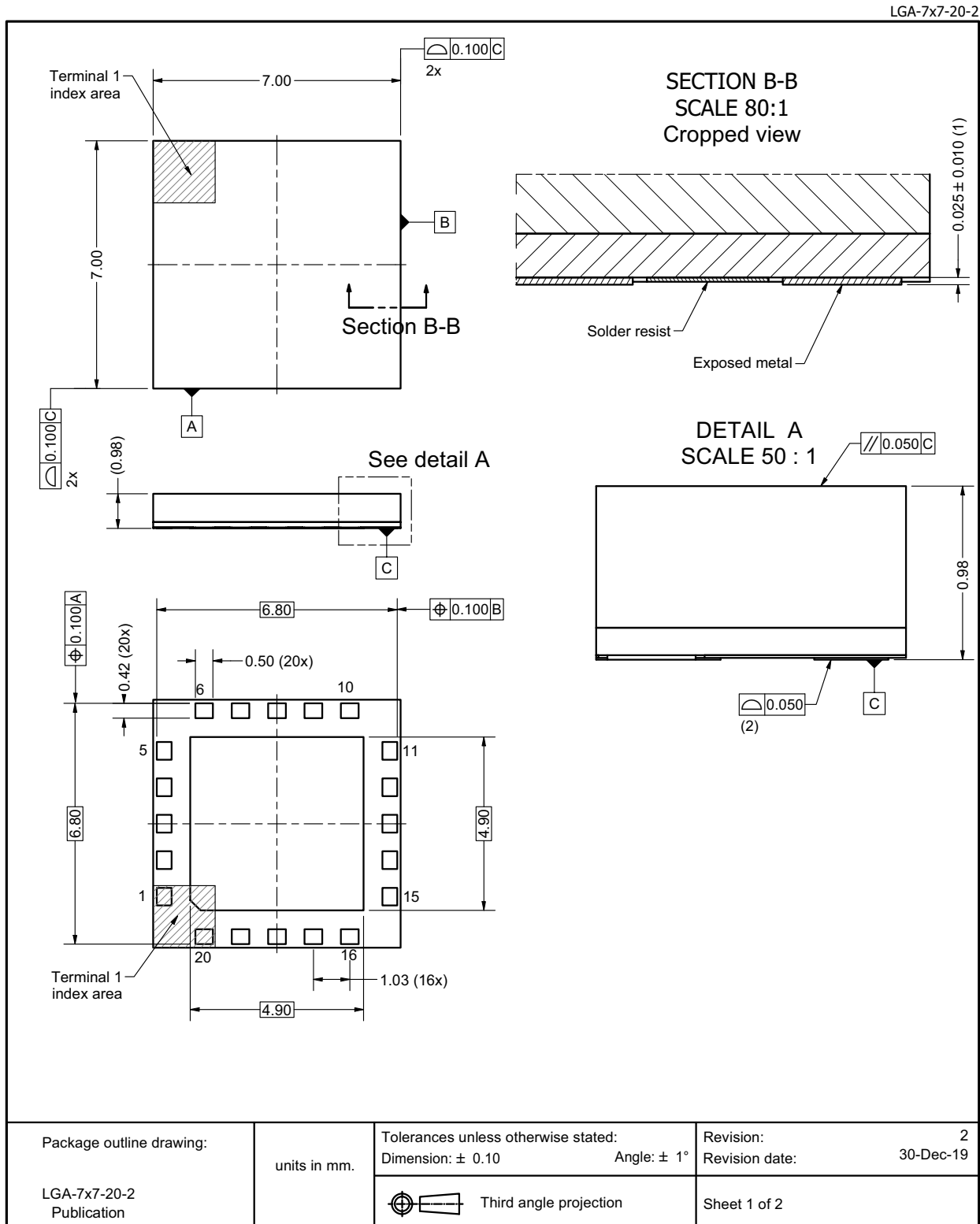


Fig 8. Package outline LGA-7x7-20-2 (sheet 1 of 2)

10. Handling information


CAUTION	
	<p>This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.</p> <p>Such precautions are described in the <i>ANSI/ESD S20.20</i>, <i>IEC/ST 61340-5</i>, <i>JESD625-A</i> or equivalent standards.</p>

Table 10. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1C [2]

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 1C is granted to any part that passes after exposure to an ESD pulse of 1000 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
BLM9D0708-05AM v.1	20210204	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".

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Date of release: 4 February 2021

Document identifier: BLM9D0708-05AM