



**THE DATASHEET OF
BLM9D1822-30BZ**



BLM9D1822-30B

LDMOS 2-stage integrated Doherty MMIC

Rev. 2 — 13 December 2019

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The BLM9D1822-30B is a 2-stage 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 general purpose driver or small cell final in the frequency range from 1800 MHz to 2200 MHz. Available in PQFN outline.

Table 1. Application performance

Typical RF performance at $T_{case} = 25\text{ }^{\circ}\text{C}$; $I_{DQ} = 107\text{ mA}$ (carrier and peaking). Test signal: 1-carrier LTE 20 MHz; PAR = 7.6 dB; measured in an Ampleon $f = 1990\text{ MHz}$ integrated Doherty application circuit.

Test signal	f	V _{DS}	P _{L(AV)}	G _p	η_D	ACPR _{5M}
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)
1-carrier LTE 20 MHz	2000	28	2	28.5	28	-45.7

1.2 Features and benefits

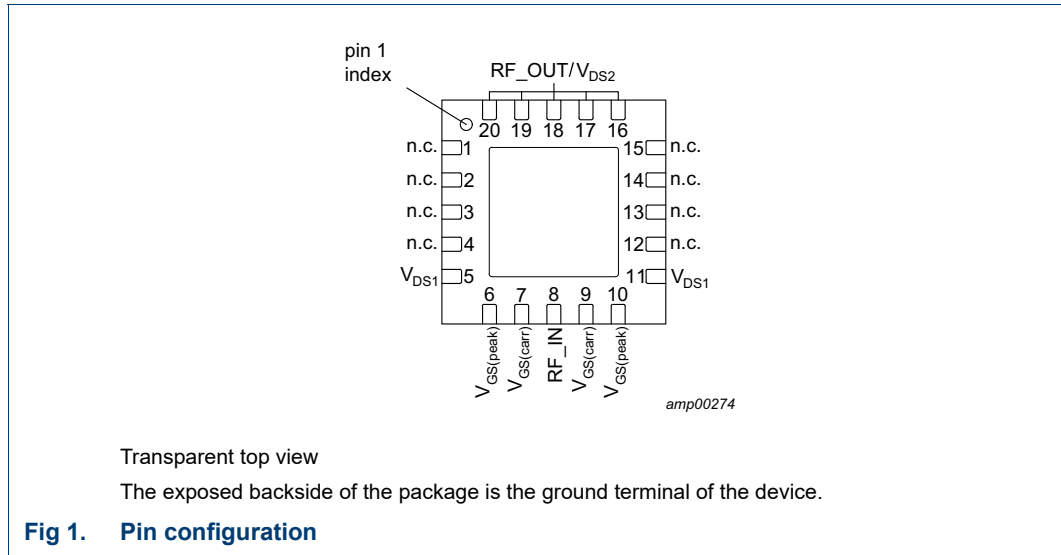
- Integrated input splitter
- Integrated output combiner
- high efficiency
- Designed for broadband operation (frequency 1800 MHz to 2200 MHz)
- Independent control of carrier and peaking bias
- Integrated ESD protection
- Excellent thermal stability
- Source impedance 50 Ω ; high power gain
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- RF power MMIC for multi-carrier and multi-standard GSM, W-CDMA and LTE base stations in the 1800 MHz to 2200 MHz frequency range

2. Pinning information

2.1 Pinning



2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
n.c.	1	not connected
n.c.	2	not connected
n.c.	3	not connected
n.c.	4	not connected
V_{DS1}	5	drain-source voltage of driver stages
$V_{GS(peak)}$	6	gate-source voltage of peaking
$V_{GS(carr)}$	7 [1]	gate-source voltage of carrier
RF_IN	8	RF input
$V_{GS(carr)}$	9	gate-source voltage of carrier
$V_{GS(peak)}$	10 [1]	gate-source voltage of peaking
V_{DS1}	11 [1]	drain-source voltage of driver stages
n.c.	12	not connected
n.c.	13	not connected
n.c.	14	not connected
n.c.	15	not connected
RF_OUT/ V_{DS2}	16	RF output / drain-source voltage of final stages
RF_OUT/ V_{DS2}	17	RF output / drain-source voltage of final stages
RF_OUT/ V_{DS2}	18	RF output / drain-source voltage of final stages

Table 2. Pin description ...continued

Symbol	Pin	Description
RF_OUT/ V_{DS2}	19	RF output / drain-source voltage of final stages
RF_OUT/ V_{DS2}	20	RF output / drain-source voltage of final stages
GND	flange	RF ground

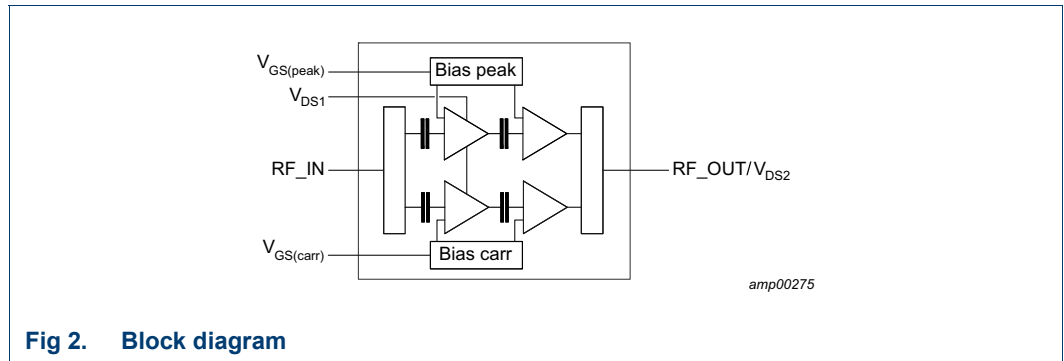
[1] Not used.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLM9D1822-30B	PQFN20	plastic thermal enhanced quad flat package; no leads; 20 terminals; body 8.0 x 8.0 x 2.1 mm	SOT1462-1

4. 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	+13	V
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature	[1]	-	200	°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} = 90 °C; P _L = 4 W	[1]	2.08	K/W
		T _{case} = 90 °C; P _L = 8 W	[1]	1.89	K/W

[1] When operated with a 1-carrier W-CDMA with PAR = 9.9 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 = 110 mA	1.7	2.1	2.5	V
I _{GSS}	gate leakage current	V _{GS} = 1 V; V _{DS} = 0 V	-	-	140	nA
Peaking						
I _{GSS}	gate leakage current	V _{GS} = 1 V; V _{DS} = 0 V	-	-	140	nA
Final stages						
I _{DSS}	drain leakage current	V _{GS} = 0 V; V _{DS} = 28 V	-	-	1.4	μA
Driver stages						
I _{DSS}	drain leakage current	V _{GS} = 0 V; V _{DS} = 28 V	-	-	1.4	μA

Table 7. RF Characteristics

Typical RF performance at T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 110 mA (carrier);
V_{GSq(peaking)} = V_{GSq(carrier)} - 0.4 V; P_{L(AV)} = 2.51 W (34 dBm); f = 2200 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: pulsed CW (t_p = 100 μs, δ = 10 %)						
G _p	power gain	P _L = 2.51 W (34 dBm)	27.1	29.3	31.3	dB
η _D	drain efficiency	P _L = 2.51 W (34 dBm)	24	27	-	%
		P _L = P _{L(3dB)}	52	55.5	-	%
RL _{in}	input return loss		-	-	-10	dB
P _{L(3dB)}	output power at 3 dB gain compression		45.0	45.9	-	dBm

8. Application information

Table 8. Typical performance

$T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{Dq} = 107\text{ mA}$ (carrier and peaking). Test signal: 1-carrier LTE 20 MHz; PAR = 7.6 dB; unless otherwise specified, measured in an Ampleon 1800 MHz to 2200 MHz frequency band symmetrical integrated Doherty application circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(1dB)}$	output power at 1 dB gain compression	$f = 2000\text{ MHz}$ [1]	-	45.1	-	dBm
$P_{L(3dB)}$	output power at 3 dB gain compression	$f = 2000\text{ MHz}$ [1]	-	45.7	-	dBm
$\varphi_{s21}/\varphi_{s21(norm)}$	normalized phase response	$f = 2000\text{ MHz}$; at 3 dB compression point; [2]	-	-3.4	-	°
η_D	drain efficiency	12.7 dB OBO ($P_{L(AV)} = 33\text{ dBm}$); $f = 2000\text{ MHz}$	-	28	-	%
G_p	power gain	$P_{L(AV)} = 33\text{ dBm}$; $f = 2000\text{ MHz}$	-	28.5	-	dB
B_{video}	video bandwidth	$P_{L(AV)} = 33\text{ dBm}$ set to obtain $IMD3 = -40\text{ dBc}$; 2-tone CW; $f = 2000\text{ MHz}$	-	231	-	MHz
G_{flat}	gain flatness	$P_{L(AV)} = 33\text{ dBm}$; $f = 1800\text{ MHz}$ to 2200 MHz	-	1.5	-	dB
$ACPR_{20M}$	adjacent channel power ratio (20M)	$P_{L(AV)} = 33\text{ dBm}$; $f = 2000\text{ MHz}$	-	-45.7	-	dBc
$\Delta G/\Delta T$	gain variation with temperature	$f = 2000\text{ MHz}$ [3]	-	0.044	-	dB/°C
K	Rollett stability factor	$T_{case} = -40\text{ °C}$; $f = 0.2\text{ GHz}$ to 5 GHz [3]	-	>3	-	

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

[2] 25 ms CW power sweep measurement.

[3] S-parameters measured with broadband demo board.

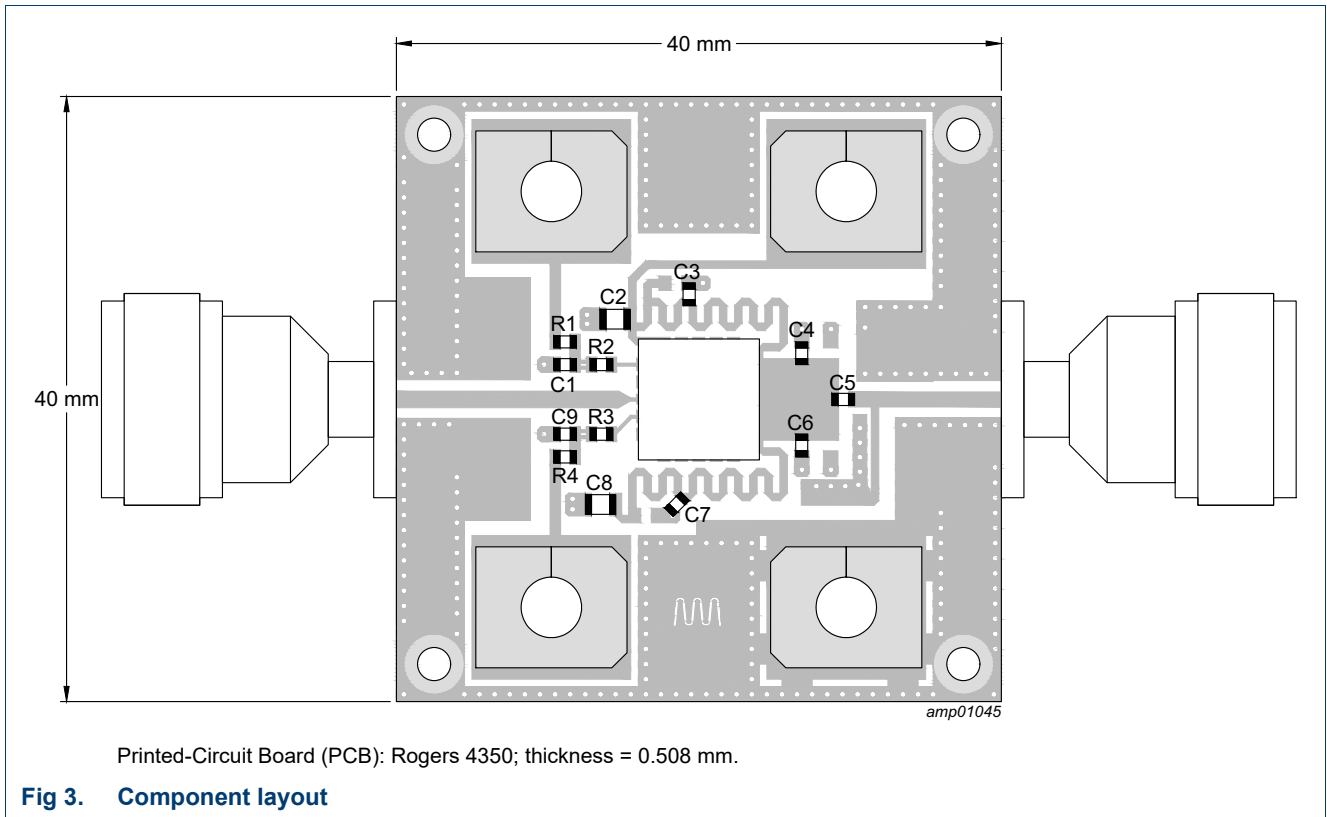


Table 9. Demo test circuit list of components
See [Figure 3](#) for component layout.

Component	Description	Value	Remarks
C1, C9	multilayer ceramic chip capacitor	10 μ F, 50 V	Murata: SMD 0603
C2, C8	multilayer ceramic chip capacitor	10 μ F, 50 V	TDK: SMD 0805
C3, C7	multilayer ceramic chip capacitor	9.1 pF	Murata: SMD 0603
C4, C6	multilayer ceramic chip capacitor	0.4 pF	Murata: SMD 0603
C5	multilayer ceramic chip capacitor	1.8 pF	Murata: SMD 0603
R1, R2, R3, R4	resistor	0 Ω	Multicomp: SMD 0603

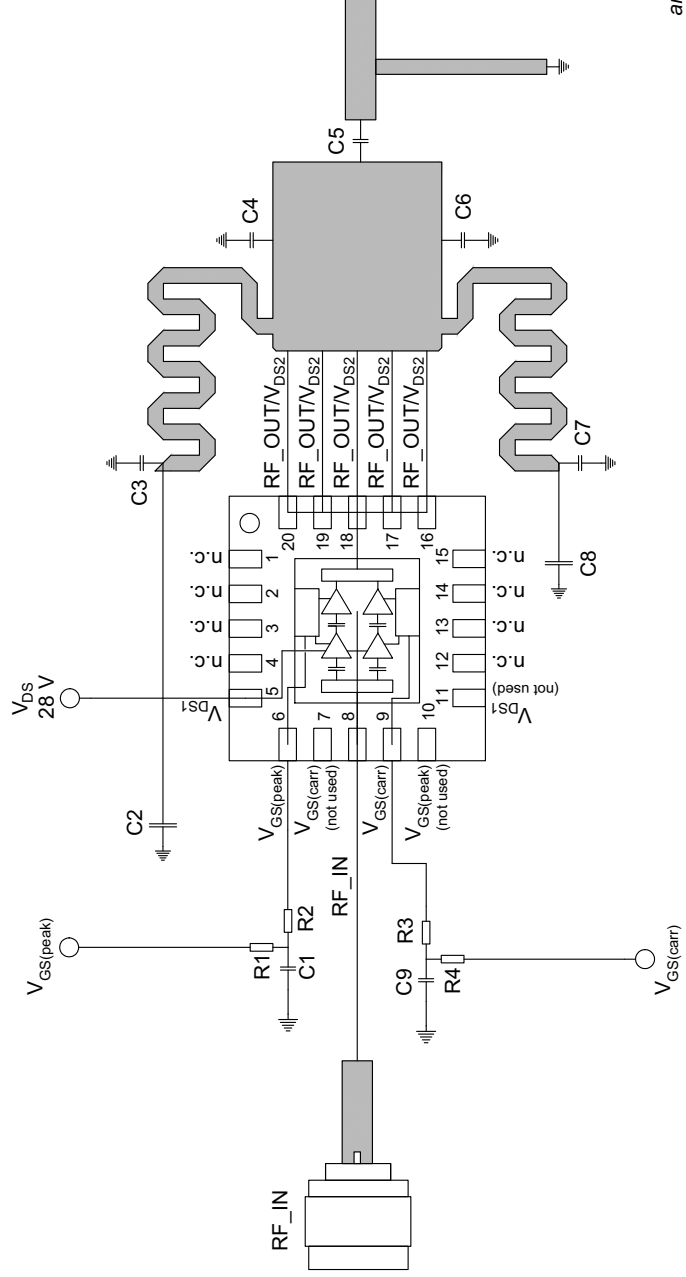


Fig 4. Electrical schematic

8.1 Ruggedness in a Doherty operation

The BLM9D1822-30B is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: $V_{DS} = 32\text{ V}$; $I_{Dq} = 110\text{ mA}$ (carrier) and $V_{GSq(peak)} - V_{GSq(carrier)} = 0.43\text{ V}$; corresponding to $P_{L(3dB)}$ under $Z_S = 50\ \Omega$ load; $f = 2000\text{ MHz}$ (60 s W-CDMA signal is used during the stress); $T_{case} = 25\text{ }^\circ\text{C}$.

8.2 Impedance information

Table 10. Typical impedance for optimum Doherty operation

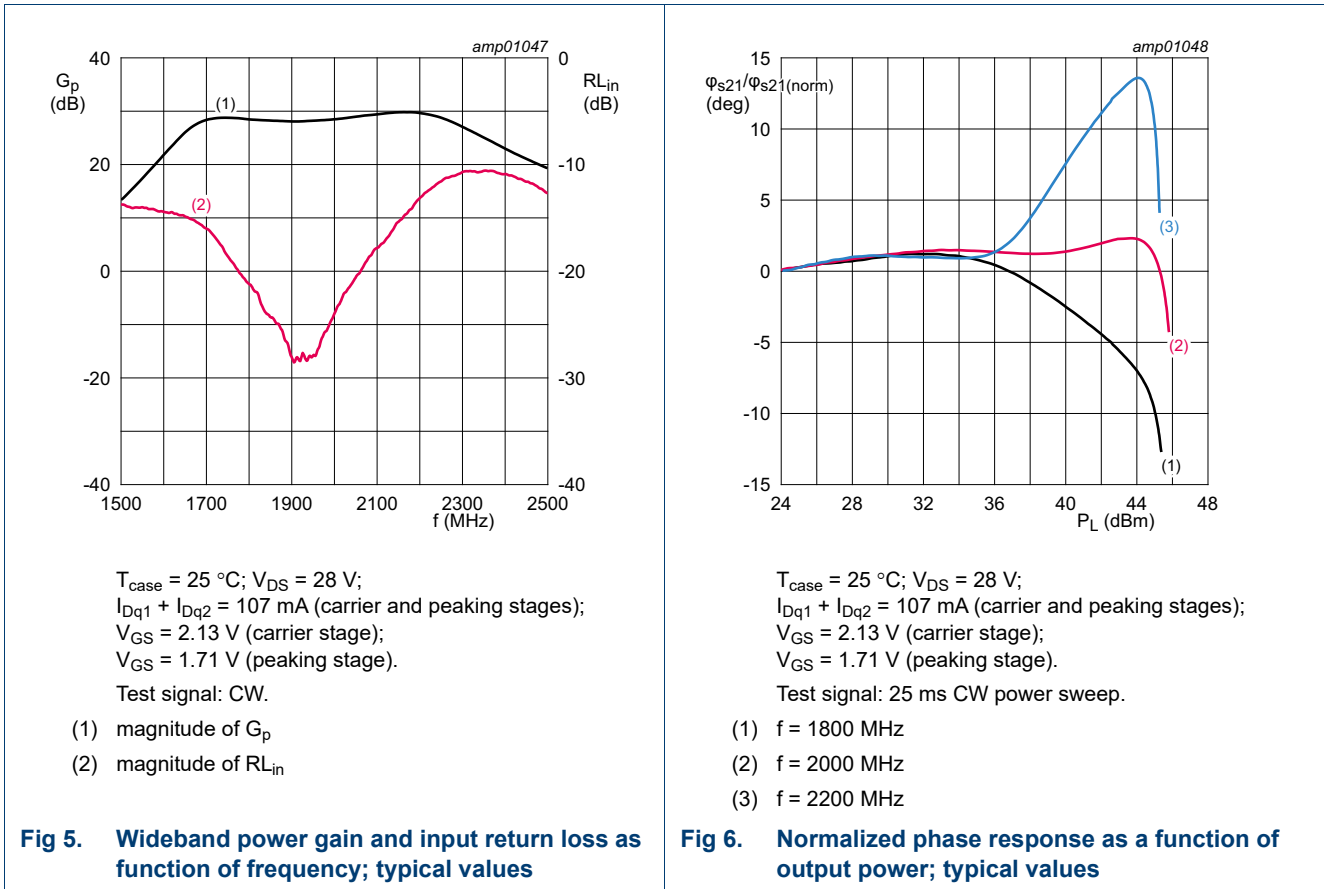
Measured load-pull data; test signal: pulsed CW; $T_{case} = 25\text{ }^\circ\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq} = 110\text{ mA}$ (carrier); $V_{GSq(peak)} = V_{GSq(carrier)} - 0.3\text{ V}$; $t_p = 100\ \mu\text{s}$; $\delta = 10\%$. Typical values unless otherwise specified.

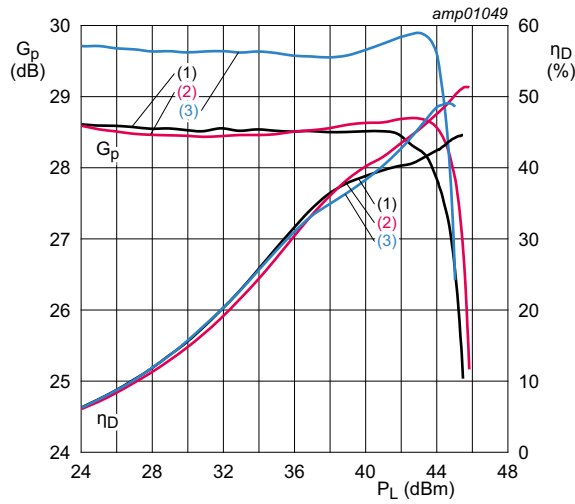
f (MHz)	tuned for optimum Doherty operation				
	Z_L (Ω)	$G_{p(max)}$ (dB)	P_L (dBm)	η_{add} [1] (%)	η_{add} [2] (%)
1700	5.6 – j7.8	30.4	45.3	46.1	25.0
1800	6.1 – j9.3	30.0	45.7	50.1	25.8
1900	7.4 – j10.6	29.9	46.1	54.6	28.5
2000	9.1 – j10.2	30.8	46.1	57.3	28.6
2100	13.6 – j9.3	32.4	45.5	57.2	28.9
2200	13.8 – j6.0	31.7	45.6	56.7	26.4

[1] At 3 dB compression point.

[2] At 34 dBm.

8.3 Graphs



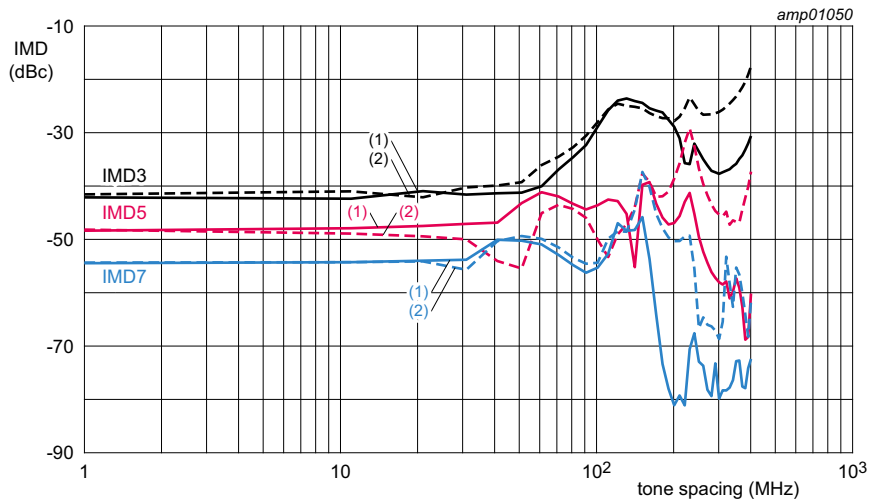


$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} + I_{Dq2} = 107\text{ mA}$ (carrier and peaking stages);
 $V_{GS} = 2.13\text{ V}$ (carrier stage); $V_{GS} = 1.71\text{ V}$ (peaking stage).

Test signal: pulsed CW power sweep ($\delta = 10\text{ }5$; $t_p = 100\text{ }\mu\text{s}$).

- (1) $f = 1800\text{ MHz}$
- (2) $f = 2000\text{ MHz}$
- (3) $f = 2200\text{ MHz}$

Fig 7. Power gain and drain efficiency as function of output power; typical values

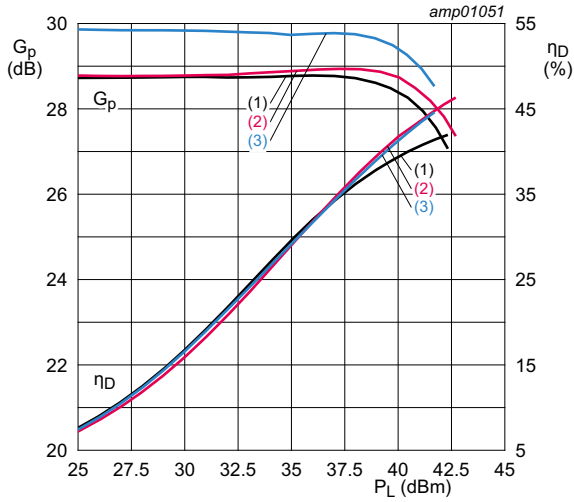


$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} + I_{Dq2} = 107\text{ mA}$ (carrier and peaking stages);
 $V_{GS} = 2.13\text{ V}$ (carrier stage); $V_{GS} = 1.71\text{ V}$ (peaking stage); $P_{L(AV)} = 2\text{ W}$.

Test signal: 2-tone CW; $f_c = 2000\text{ MHz}$.

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

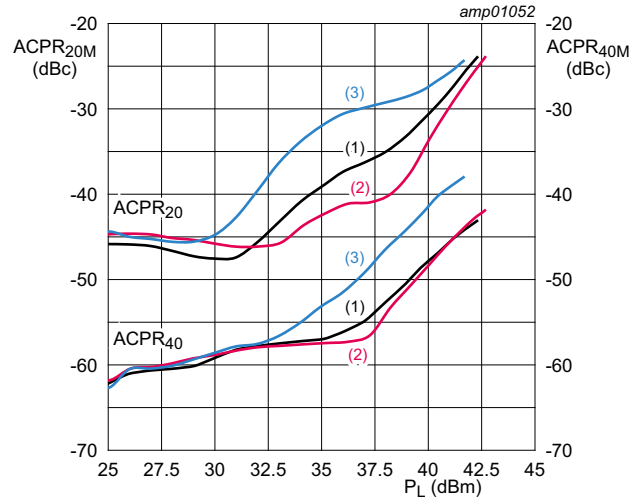
Fig 8. Intermodulation distortion as a function of tone spacing; typical values



$T_{case} = 25\text{ }^{\circ}\text{C}; V_{DS} = 28\text{ V};$
 $I_{Dq1} + I_{Dq2} = 107\text{ mA}$ (carrier and peaking stages);
 $V_{GS} = 2.13\text{ V}$ (carrier stage);
 $V_{GS} = 1.71\text{ V}$ (peaking stage).
 Test signal: 1-carrier LTE; PAR = 7.6 dB at 0.01 % probability CCDF.

- (1) $f = 1800\text{ MHz}$
- (2) $f = 2000\text{ MHz}$
- (3) $f = 2200\text{ MHz}$

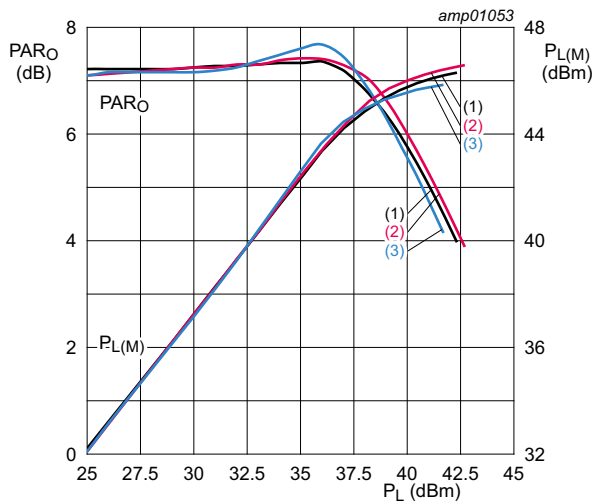
Fig 9. Power gain and drain efficiency as function of output power; typical values



$T_{case} = 25\text{ }^{\circ}\text{C}; V_{DS} = 28\text{ V};$
 $I_{Dq1} + I_{Dq2} = 107\text{ mA}$ (carrier and peaking stages);
 $V_{GS} = 2.13\text{ V}$ (carrier stage);
 $V_{GS} = 1.71\text{ V}$ (peaking stage).
 Test signal: 1-carrier LTE; PAR = 7.6 dB at 0.01 % probability CCDF.

- (1) $f = 1800\text{ MHz}$
- (2) $f = 2000\text{ MHz}$
- (3) $f = 2200\text{ MHz}$

Fig 10. Adjacent channel power ratio as a function of output power; typical values



$T_{case} = 25\text{ }^{\circ}\text{C}; V_{DS} = 28\text{ V}; I_{Dq1} + I_{Dq2} = 107\text{ mA}$ (carrier and peaking stages);
 $V_{GS} = 2.13\text{ V}$ (carrier stage); $V_{GS} = 1.71\text{ V}$ (peaking stage).
 Test signal: 1-carrier LTE; PAR = 7.6 dB at 0.01 % probability CCDF.

- (1) $f = 1800\text{ MHz}$
- (2) $f = 2000\text{ MHz}$
- (3) $f = 2200\text{ MHz}$

Fig 11. Output peak-to-average ratio and peak output power as function of output power; typical values

9. Package outline

PQFN20: plastic thermal enhanced quad flat package; no leads; 20 terminals; body 8.0 x 8.0 x 2.1 mm

SOT1462-1

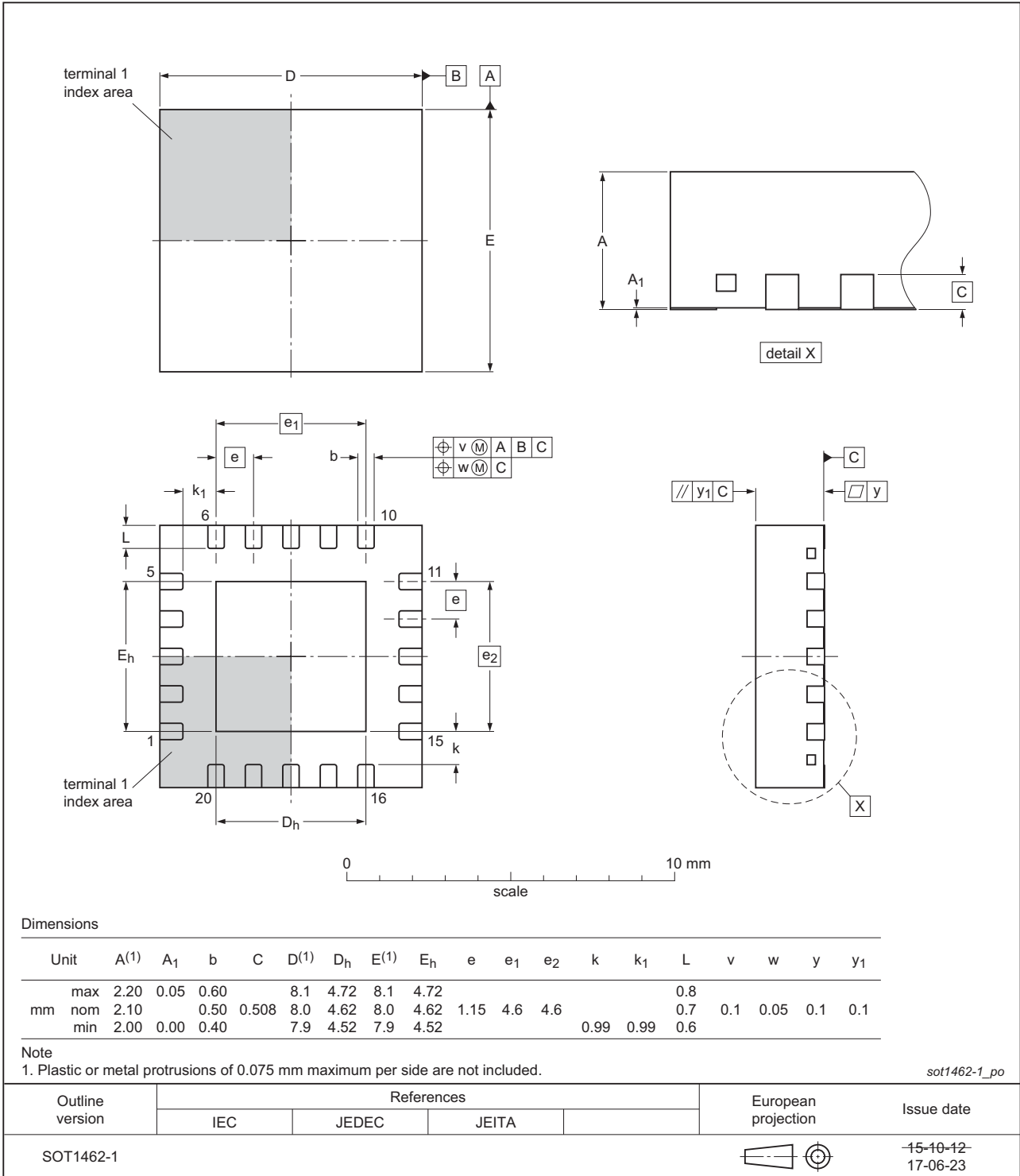


Fig 12. Package outline SOT1462-1 (PQFN20)

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 11. 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 12. Abbreviations

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
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
OBO	Output Back Off
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

12. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLM9D1822-30B v.2	20191213	Product data sheet	-	BLM9D1822-30B v.1
Modifications:	<ul style="list-style-type: none"> Official product release, restrictions removed 			
BLM9D1822-30B v.1	20191025	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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