

BLM9D2327-26B

LDMOS 2-stage integrated Doherty MMIC

Rev. 2 — 1 March 2019

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The BLM9D2327-26B is a thermally enhanced 2-stage fully integrated 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 2300 MHz to 2700 MHz. Available in PQFN outline.

Table 1. Application performance

Typical RF performance measured in a wideband 2300 MHz to 2700 MHz application board at $T_{case} = 25\text{ }^{\circ}\text{C}$; $I_{Dq} = 75\text{ mA}$ (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.98\text{ V}$. Test signal: 1-carrier LTE 20 MHz; PAR = 7.2 dB at 0.01% probability on CCDF.

Test signal	f	V _{DS}	P _{L(AV)}	G _p [1]	η _D [1]
	(MHz)	(V)	(W)	(dB)	(%)
single carrier LTE 20 MHz	2500	28	4.9	27.9	41.1

[1] At P_{L(AV)}.

1.2 Features and benefits

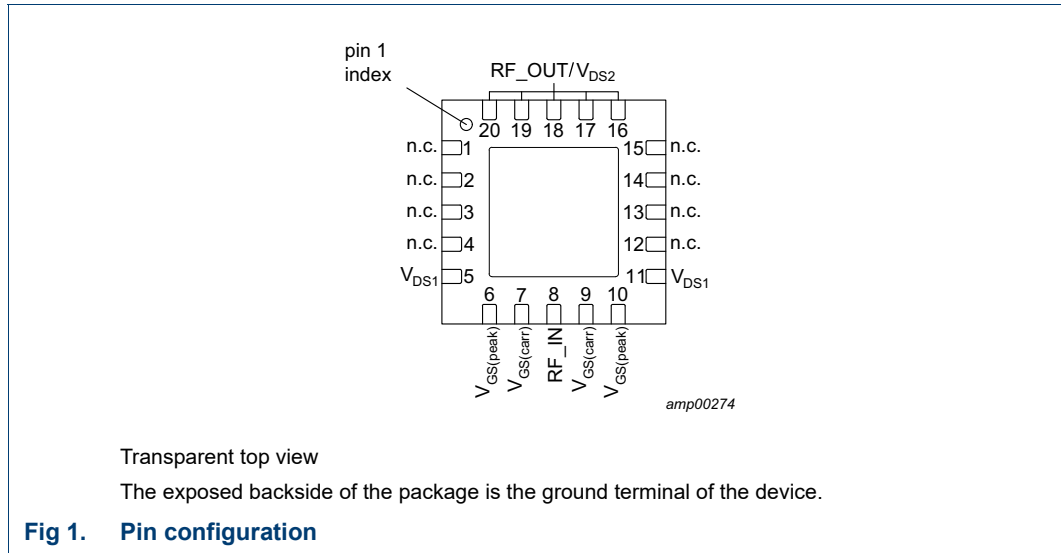
- Integrated input splitter
- Integrated output combiner
- High efficiency
- Designed for broadband operation (frequency 2300 MHz to 2700 MHz)
- Independent control of carrier and peaking bias
- Integrated ESD protection
- Source impedance 50 Ω; high power gain
- For RoHS compliance see the product details 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 2300 MHz to 2700 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	gate-source voltage of carrier
RF_IN	8	RF input
$V_{GS(carr)}$	9	gate-source voltage of carrier
$V_{GS(peak)}$	10	gate-source voltage of peaking
V_{DS1}	11	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

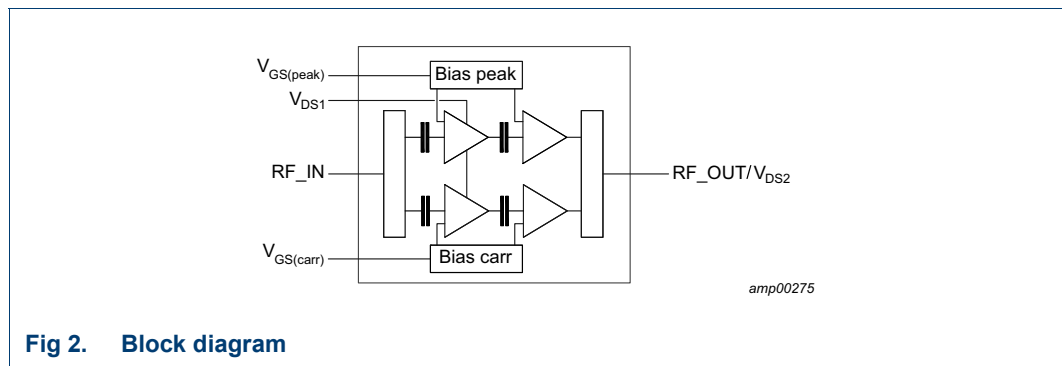
Symbol	Pin	Description
RF_OUT/ V_{DS2}	19	RF output / drain-source voltage of final stages
RF_OUT/ V_{DS2}	20	RF output / drain-source voltage of final stages
GND	flange	RF ground

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLM9D2327-26B	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		-0.5	+65	V
V_{GS}	gate-source voltage		-0.5	+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

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_{case} = 90\text{ °C}; P_L = 2.5\text{ W}$ [1]	3.34	K/W
		$T_{case} = 90\text{ °C}; P_L = 5\text{ W}$ [1]	3.23	K/W

[1] When operated with a 1-carrier W-CDMA with PAR = 9.9 dB.

7. Characteristics

Table 6. DC characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Carrier						
V_{GSq}	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 75\text{ mA}$	1.7	2	2.6	V
I_{GSS}	gate leakage current	$V_{GS} = 1\text{ V}; V_{DS} = 0\text{ V}$	-	-	140	nA
Peaking						
I_{GSS}	gate leakage current	$V_{GS} = 1\text{ V}; V_{DS} = 0\text{ V}$	-	-	140	nA
Final stages						
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$	-	-	1.4	μA
Driver stages						
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$	-	-	1.4	μA

Table 7. RF Characteristics

Typical RF performance at $T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{Dq} = 75\text{ mA}$ (carrier);
 $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.65\text{ V}$; $P_{L(AV)} = 5\text{ W}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: single carrier pulsed CW [1]						
G_p	power gain	$f = 2700\text{ MHz}$	27.3	29.3	31.3	dB
η_D	drain efficiency	$P_L = 5\text{ W}$ (37 dBm)	35	40	-	%
		$P_L = P_{L(3dB)}$	46	50	-	%
RL_{in}	input return loss		-	-	-10	dB
$P_{L(3dB)}$	output power at 3 dB gain compression		44.0	44.8	-	dBm

[1] $t_p = 0.1\text{ ms}$; $\delta = 10\%$.

8. Application information

Table 8. Typical performance

$T_{case} = 25\text{ °C}$; $V_{DS} = 28\text{ V}$; $I_{Dq} = 75\text{ mA}$ (driver and final stages); $V_{GSq(peak)} = V_{GSq(carrier)} - 0.98\text{ V}$. Test signal: 1-carrier LTE 20 MHz; PAR = 7.2 dB at 0.01 % probability CCDF, unless otherwise specified; typical performance in an Ampleon 2300 MHz to 2700 MHz frequency band application circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(3dB)}$	output power at 3 dB gain compression	f = 2500 MHz [1]	-	45	-	dBm
$\varphi_{s21}/\varphi_{s21(norm)}$	normalized phase response	f = 2500 MHz at 3 dB compression point [2]	-	-7.1	-	°
η_D	drain efficiency	8 dB OBO ($P_{L(AV)} = 36.9\text{ dBm}$); f = 2500 MHz	-	41.1	-	%
G_p	power gain	$P_{L(AV)} = 36\text{ dBm}$; f = 2500 MHz	-	27.9	-	dB
B_{video}	video bandwidth	$P_{L(AV)} = 36\text{ dBm}$ set to obtain IMD3 = -30 dBc; 2-tone CW; f = 2500 MHz	-	421	-	MHz
G_{flat}	gain flatness	$P_{L(AV)} = 36\text{ dBm}$; f = 2300 MHz to 2700 MHz	-	0.86	-	dB
$ACPR_{20M}$	adjacent channel power ratio (20M)	$P_{L(AV)} = 36\text{ dBm}$; f = 2500 MHz	-	-38.6	-	dBc
K	Rollett stability factor	$T_{case} = -40\text{ °C}$; f = 0.1 GHz to 6 GHz [3]	-	>1.7	-	

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

[2] 25 ms CW power sweep measurement.

[3] For both sections (S-parameters).

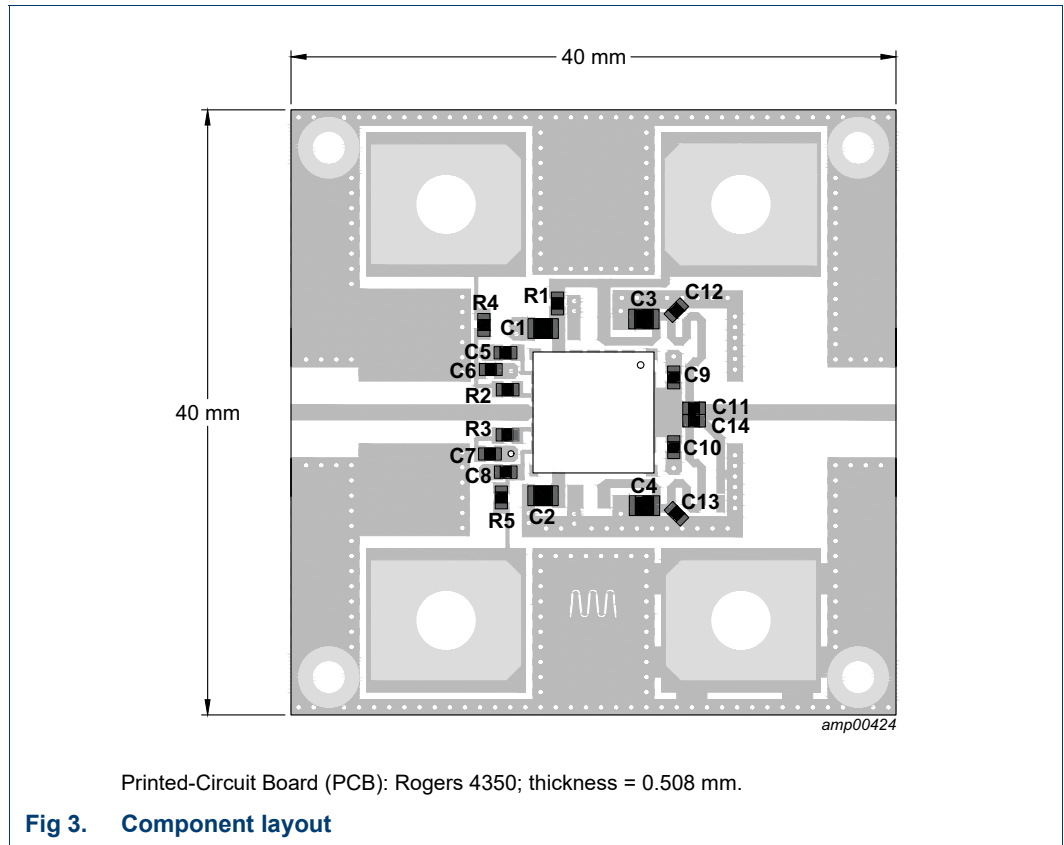
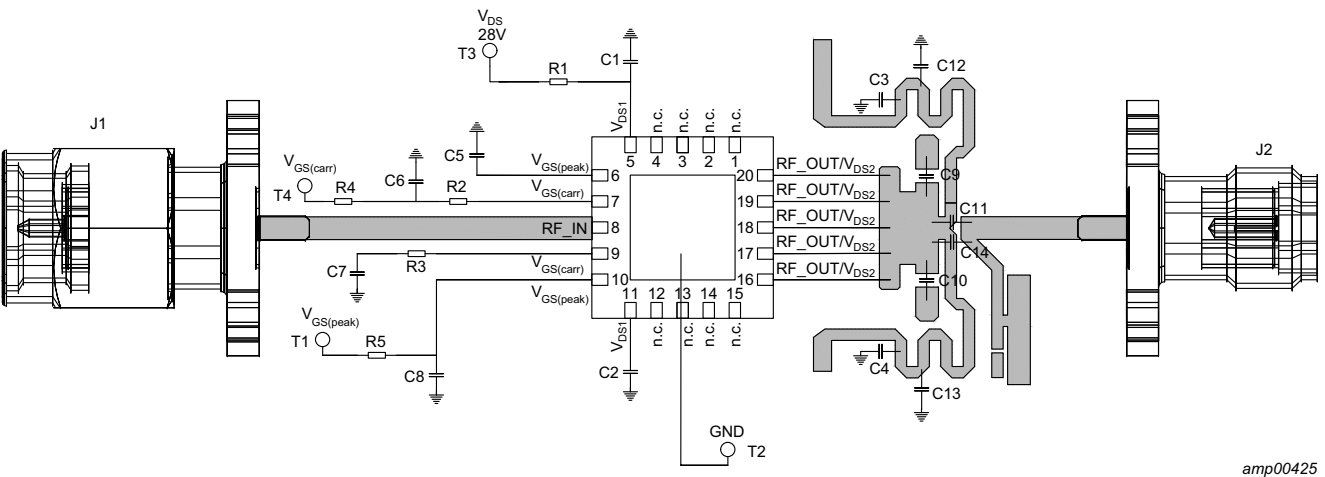


Table 9. Demo test circuit list of components

See [Figure 3](#) for component layout.

Component	Description	Value	Remarks
C1, C2, C3, C4	multilayer ceramic chip capacitor	10 μ F, 35 V	TDK: C2012X5R1V106M085AC
C5, C6, C7, C8	multilayer ceramic chip capacitor	1 μ F, 25 V	AVX: 06033D105KAT2A
C9, C10	multilayer ceramic chip capacitor	1.8 pF	Murata: GQM1875C2E1R6BB12
C11	multilayer ceramic chip capacitor	1.6 pF	Murata: GQM1875C2E5R6BB12
C12, C13	multilayer ceramic chip capacitor	9.1 pF	Murata: GQM1875C2E5R6BB12
C14	multilayer ceramic chip capacitor	0.5 pF	Murata: GQM1875C2E5R6BB12
J1	SMA Coaxial panel connector male		Hubner & Suhner: 13_SMA-50-0-2/111_N
J2	SMA Coaxial panel connector female		Hubner & Suhner: 23_SMA-50-0-2/111_N
R1	SMD resistor	0 Ω , \pm 1 %	Multicomp: MC805
R2, R3	SMD resistor	5.1 Ω , \pm 1 %	Multicomp: MC805
R4	SMD resistor	820 Ω , \pm 1 %	Multicomp: MC805
R5	SMD resistor	10 Ω , \pm 1 %	Multicomp: MC805
T1, T2, T3, T4	PCB Terminal	6.35 mm \times 0.81 mm, 4.1 mm	TE connectivity



amp00425

Fig 4. Electrical schematic

8.1 Ruggedness in a Doherty operation

The BLM9D2327-26B is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: $V_{DS} = 32\text{ V}$; $I_{Dq} = 75\text{ mA}$ (carrier); $V_{GSq(peak)} = V_{GSq(carrier)} - 0.7\text{ V}$; P_1 corresponding to $P_{L(3dB)}$ under $Z_S = 50\ \Omega$ load; $f = 2700\text{ MHz}$ (pulsed CW); $T_{case} = 25\text{ }^\circ\text{C}$.

8.2 Impedance information

Table 10. Typical impedance for optimum Doherty operation

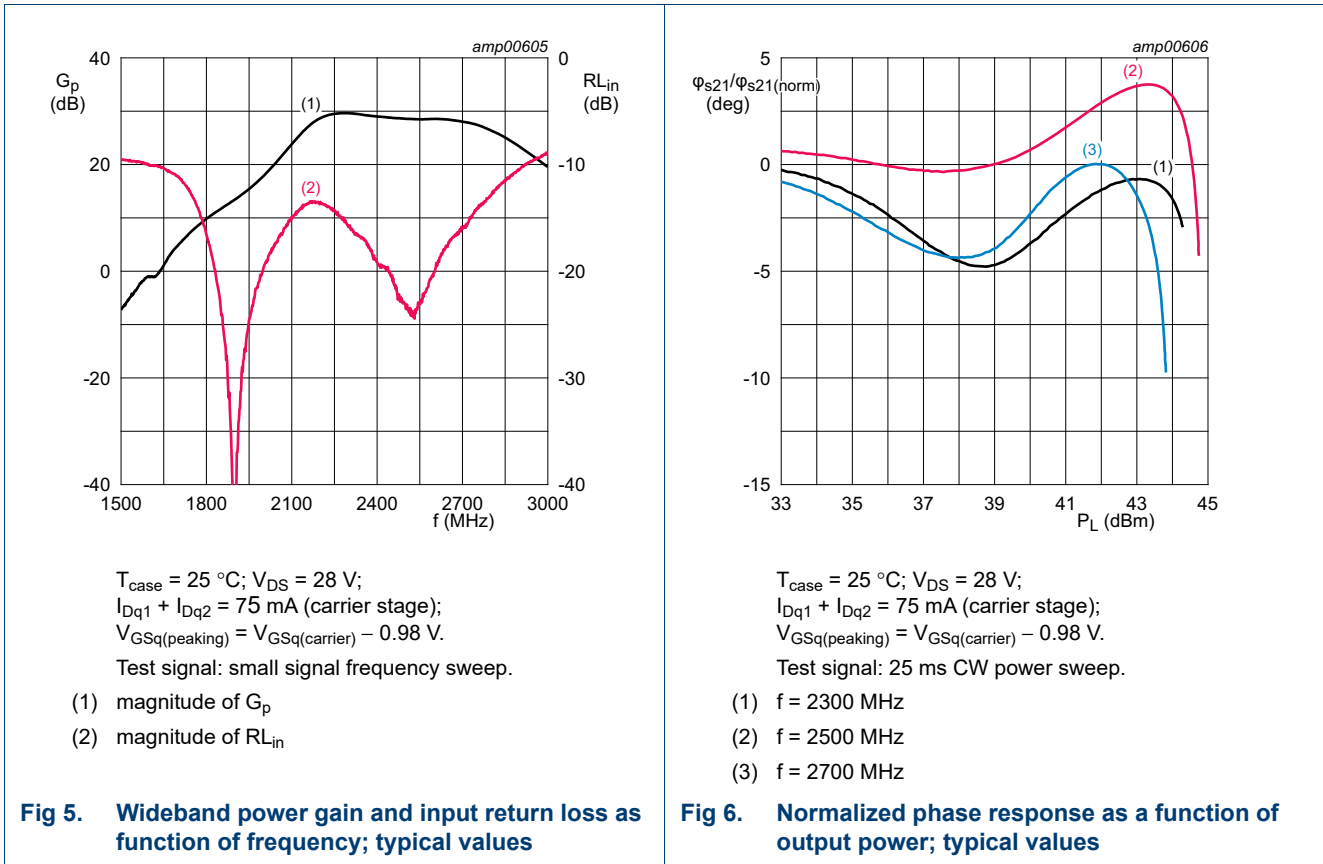
Measured load-pull data; test signal: pulsed CW; $T_{case} = 25\text{ }^\circ\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq} = 70\text{ mA}$ (carrier); $V_{GSq(peak)} = V_{GSq(carrier)} - 0.65\text{ V}$; $t_p = 100\ \mu\text{s}$; $\delta = 10\%$.

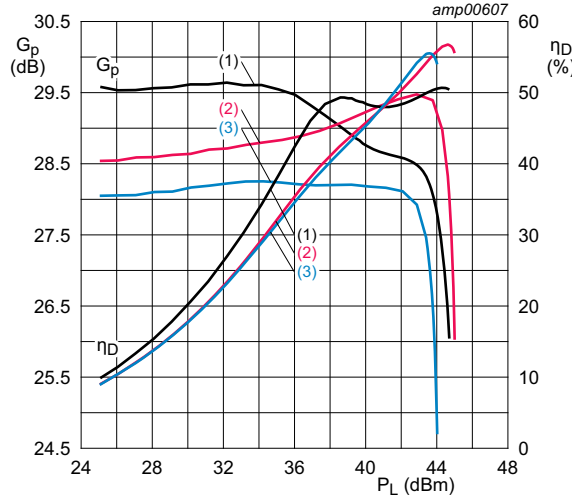
f (MHz)	tuned for optimum Doherty operation				
	Z_L (Ω)	$P_{L(3dB)}$ (dBm)	$G_{p(max)}$ (dB)	η_{add} [1] (%)	η_{add} [2] (%)
2300	5.27 – j2.76	45.09	28.23	51.87	43.20
2500	5.90 – j3.87	45.13	28.18	54.23	43.04
2700	7.11 – j3.48	44.55	27.97	56.22	38.74

[1] At 44.5 dBm.

[2] At 36.5 dBm.

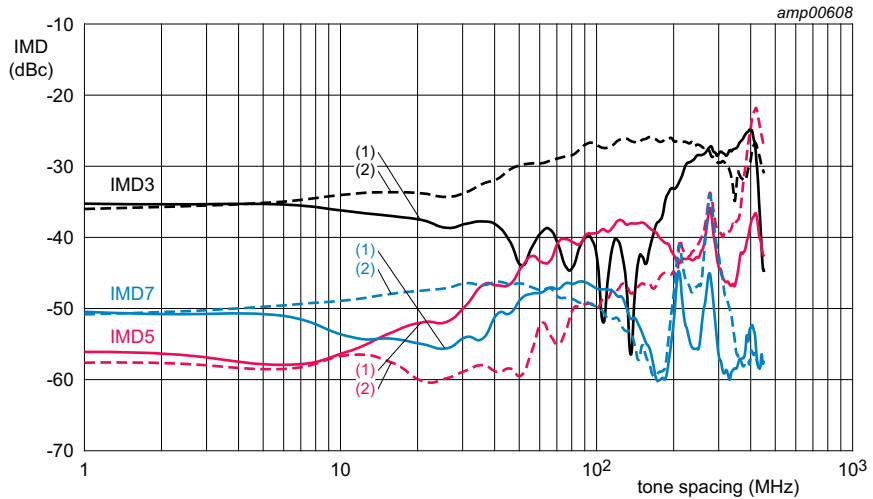
8.3 Graphs





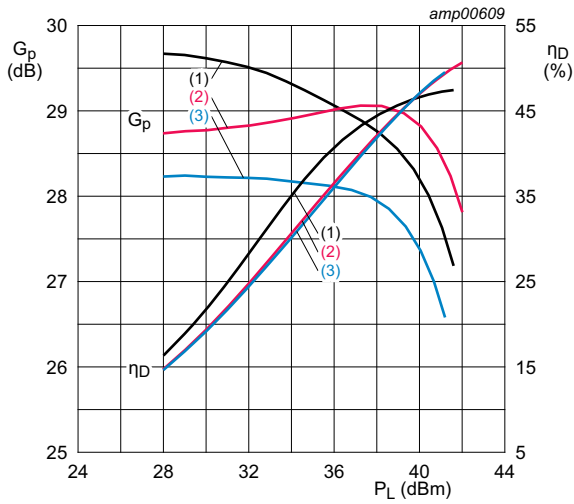
$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} + I_{Dq2} = 75\text{ mA}$ (carrier stage);
 $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.98\text{ V}$.
 Test signal: pulsed CW power sweep ($\delta = 10\%$; $t_p = \mu\text{s}$).
 (1) $f = 2300\text{ MHz}$
 (2) $f = 2500\text{ MHz}$
 (3) $f = 2700\text{ MHz}$

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



$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} + I_{Dq2} = 75\text{ mA}$ (carrier stage);
 $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.98\text{ V}$; $P_{L(AV)} = 4\text{ W}$.
 Test signal: 2-tone CW; $f_c = 2500\text{ MHz}$.
 (1) IMD low
 (2) IMD high

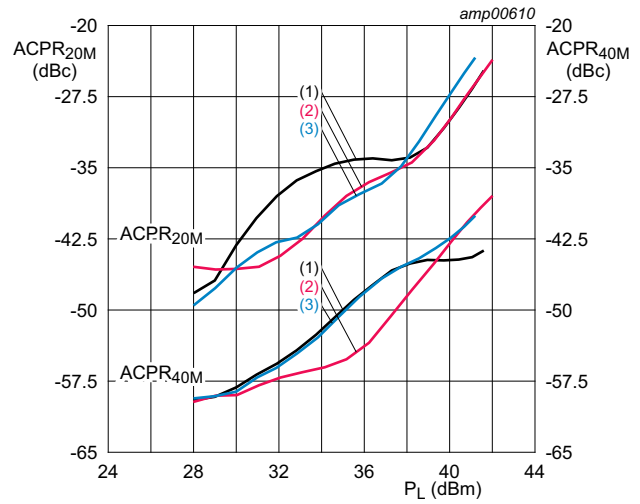
Fig 8. Intermodulation distortion as a function of tone spacing; typical values



$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$;
 $I_{Dq1} + I_{Dq2} = 75\text{ mA}$ (carrier stage);
 $V_{GSq(peak)} = V_{GSq(carrier)} - 0.98\text{ V}$.
 Test signal: 1-carrier LTE; PAR = 7.2 dB at 0.01 % probability CCDF.

- (1) $f = 2300\text{ MHz}$
- (2) $f = 2500\text{ MHz}$
- (3) $f = 2700\text{ MHz}$

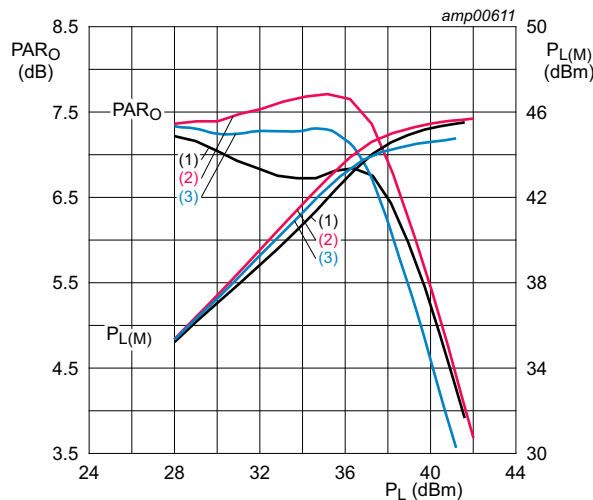
Fig 9. Power gain and drain efficiency as function of output power; typical values



$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$;
 $I_{Dq1} + I_{Dq2} = 75\text{ mA}$ (carrier stage);
 $V_{GSq(peak)} = V_{GSq(carrier)} - 0.98\text{ V}$.
 Test signal: 1-carrier LTE; PAR = 7.2 dB at 0.01 % probability CCDF.

- (1) $f = 2300\text{ MHz}$
- (2) $f = 2500\text{ MHz}$
- (3) $f = 2700\text{ MHz}$

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



$T_{case} = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 28\text{ V}$; $I_{Dq1} + I_{Dq2} = 75\text{ mA}$ (carrier stage);
 $V_{GSq(peak)} = V_{GSq(carrier)} - 0.98\text{ V}$.
 Test signal: 1-carrier LTE; PAR = 7.2 dB at 0.01 % probability CCDF.

- (1) $f = 2300\text{ MHz}$
- (2) $f = 2500\text{ MHz}$
- (3) $f = 2700\text{ MHz}$

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

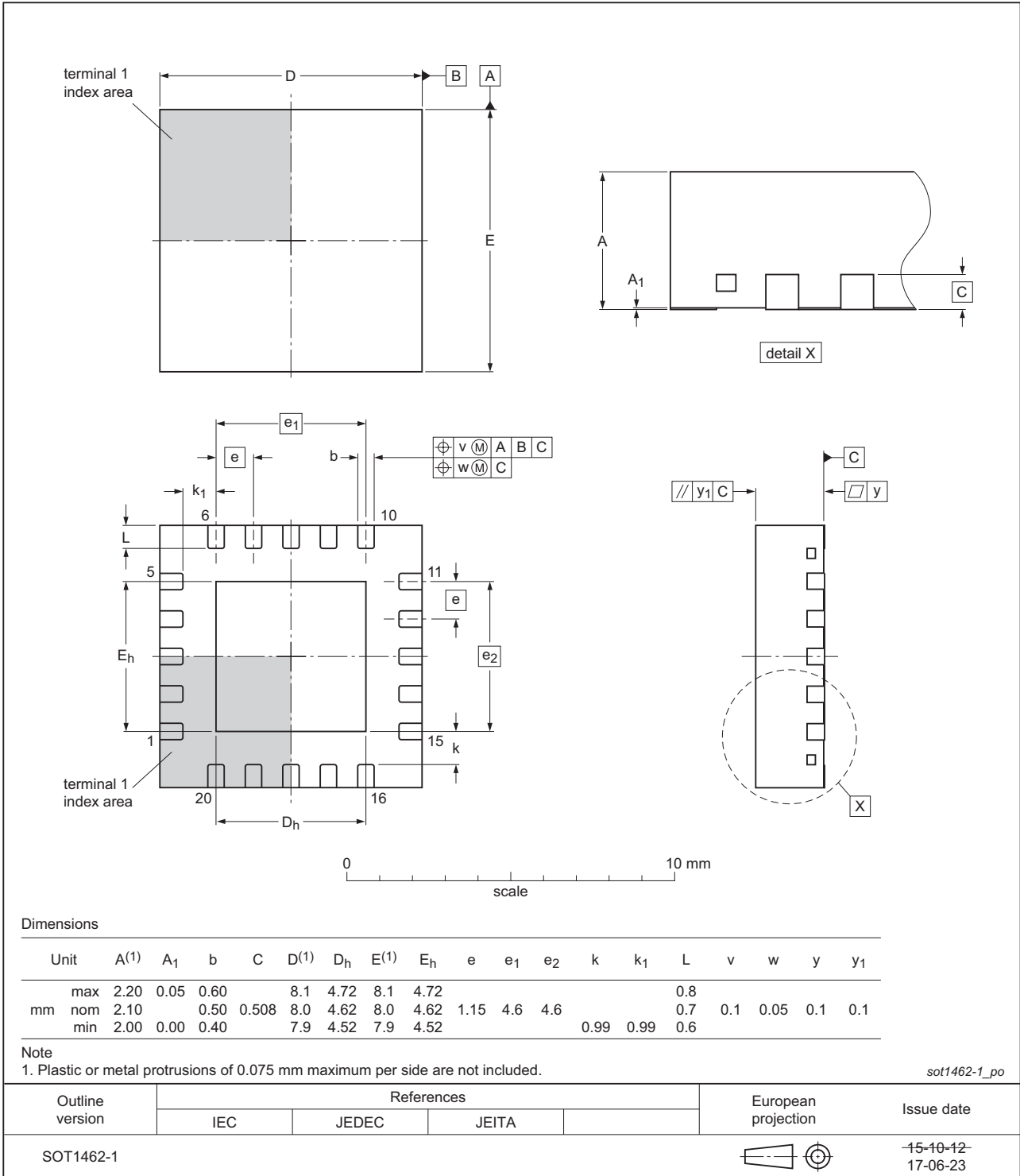


Fig 12. Package outline SOT1462-1 (PQFN20)

10. Handling information

CAUTION



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 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	1B [2]

- [1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.
- [2] HBM classification 1B is granted to any part that passes after exposure to an ESD pulse of 500 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
BLM9D2327-26B v.2	20190301	Product data sheet	-	BLM9D2327-26B v.1
Modifications	<ul style="list-style-type: none"> • Table 1 on page 1: table updated • Table 5 on page 4: table updated • Table 6 on page 4: table updated • Table 7 on page 4: table updated • Table 8 on page 5: table updated • Section 8.1 on page 8: section updated 			
BLM9D2327-26B v.1	20180312	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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