B10G2327N55D

LDMOS 2-stage integrated Doherty MMIC

Rev. 1 — 11 November 2022

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The B10G2327N55D is a 2-stage fully integrated asymmetrical Doherty MMIC solution using Ampleon's state of the art LDMOS technology. The carrier and peaking device, input splitter, output combiner and pre-match are integrated in a single package. This device is perfectly suited as general purpose driver or mMIMO final in the frequency range from 2300 MHz to 2700 MHz. Available in PQFN outline.

Table 1. Application performance

Typical RF performance at T_{case} = 25 °C; I_{Dq} = 49 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.31$ V. Test signal: 1-carrier LTE 20 MHz; PAR = 7.6 dB at 0.01 % probability CCDF measured in an Ampleon f = 2600 MHz integrated Doherty application circuit.

Test signal	f	V_{DS}	$P_{L(AV)}$	G_p	η_D
	(MHz)	(V)	(W)	(dB)	(%)
1-carrier LTE 20 MHz PAR = 7.6 dB	2600	28	2.51	29.9	35.6

1.2 Features and benefits

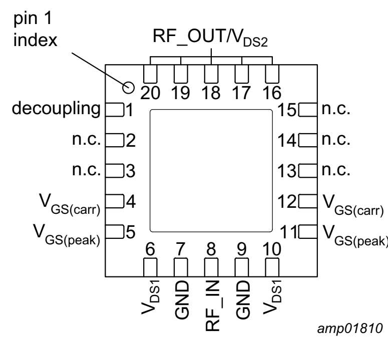
- Integrated input splitter
- Integrated output combiner
- Source impedance 50 Ω
- Pre-matched output
- High efficiency by asymmetric Doherty design
- Designed for large RF and instantaneous bandwidth operation, covering frequency from 2300 MHz to 2700 MHz
- Independent control of carrier and peaking bias
- Integrated ESD protection
- 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



Transparent top view.

The exposed backside of the package is the ground terminal of the device.

Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
decoupling	1	video-lead for decoupling
n.c.	2	not connected
n.c.	3	not connected
$V_{GS(carr)}$	4	gate-source voltage of carrier [1]
$V_{GS(peak)}$	5	gate-source voltage of peaking [2]
V_{DS1}	6	drain-source voltage of driver stages [3]
GND	7	RF ground
RF_IN	8	RF input
GND	9	RF ground
V_{DS1}	10	drain-source voltage of driver stages [3]
$V_{GS(peak)}$	11	gate-source voltage of peaking [2]
$V_{GS(carr)}$	12	gate-source voltage of carrier [1]
n.c.	13, 14, 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
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] Pins connected together.

[2] Pins connected together.

[3] $I_{max(DC)} \leq 300$ mA.

3. Ordering information

Table 3. Ordering information

Package name	Orderable part number	12NC	Packing description	Min. orderable quantity (pieces)
SOT1462-1	B10G2327N55DZ	9349 605 86515	TR13; 500-fold; 16 mm; dry pack	500

4. Block diagram

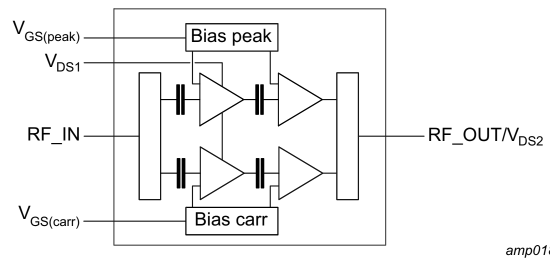


Fig 2. Block diagram

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		–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

V_{DS} = 28 V; I_{Dq} = 49 mA (carrier); $V_{GSq(peaking)}$ = $V_{GSq(carrier)}$ = –0.31 V.

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_{case} = 90 °C; P_L = 2.51 W [1]	4.5	K/W
		T_{case} = 90 °C; P_L = 7.94 W [1]	3.1	K/W
		T_{case} = 90 °C; P_L = 10 W [1]	2.8	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.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Carrier						
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 42 mA	1.8	2.2	2.54	V
I_{GSS}	gate leakage current	V_{GS} = 9 V; V_{DS} = 0 V	-	-	320	nA
Peaking						
I_{GSS}	gate leakage current	V_{GS} = 9 V; V_{DS} = 0 V	-	-	320	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} = 42 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.4$ V; $P_{L(AV)}$ = 8 W; f = 2500 MHz measured in an Ampleon production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Test signal: pulsed CW [1]						
G_p	power gain		24.8	27.5	31.2	dB
η_D	drain efficiency	P_L = 8 W (39 dBm)	35	43	-	%
		$P_L = P_{L(3dB)}$	42	48	-	%
RL_{in}	input return loss		-	-	−10	dB
$P_{L(3dB)}$	output power at 3 dB gain compression		45.9	46.8	-	dBm

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

8. Application information

8.1 Typical performance as driver application

Table 8. Typical performance

T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 49 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.31$ V. Test signal: 1-carrier W-CDMA; PAR = 9.9 dB measured in an Ampleon 2500 MHz to 2700 MHz frequency band application circuit.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$P_{L(1dB)}$	output power at 1 dB gain compression	f = 2600 MHz	[1]	-	46.4	-	dBm
$P_{L(3dB)}$	output power at 3 dB gain compression	f = 2600 MHz	[1]	-	47.3	-	dBm
$\varphi_{s21}/\varphi_{s21(norm)}$	normalized phase response	at 1 dB compression point; f = 2600 MHz	[2]	-	−8.9	-	°
η_D	drain efficiency	13.5 dB OBO ($P_{L(AV)}$ = 34 dBm); f = 2600 MHz		-	35.7	-	%
G_p	power gain	$P_{L(AV)}$ = 34 dBm; f = 2600 MHz		-	30	-	dB
B_{video}	video bandwidth	$P_{L(AV)}$ = 34 dBm; f = 2600 MHz	[3]	-	>400	-	MHz
G_{flat}	gain flatness	$P_{L(AV)}$ = 34 dBm; f = 2500 MHz to 2700 MHz		-	0.3	-	dB
$ACPR_{5M}$	adjacent channel power ratio (5M)	$P_{L(AV)}$ = 34 dBm; f = 2600 MHz		-	−38.5	-	dBc
$\Delta G/\Delta T$	gain variation with temperature	f = 2600 MHz	[4]	-	0.05	-	dB/°C
K	Rollett stability factor	T_{case} = −40 °C to +125 °C; f = 0.2 GHz to 6 GHz	[4]	-	>1	-	

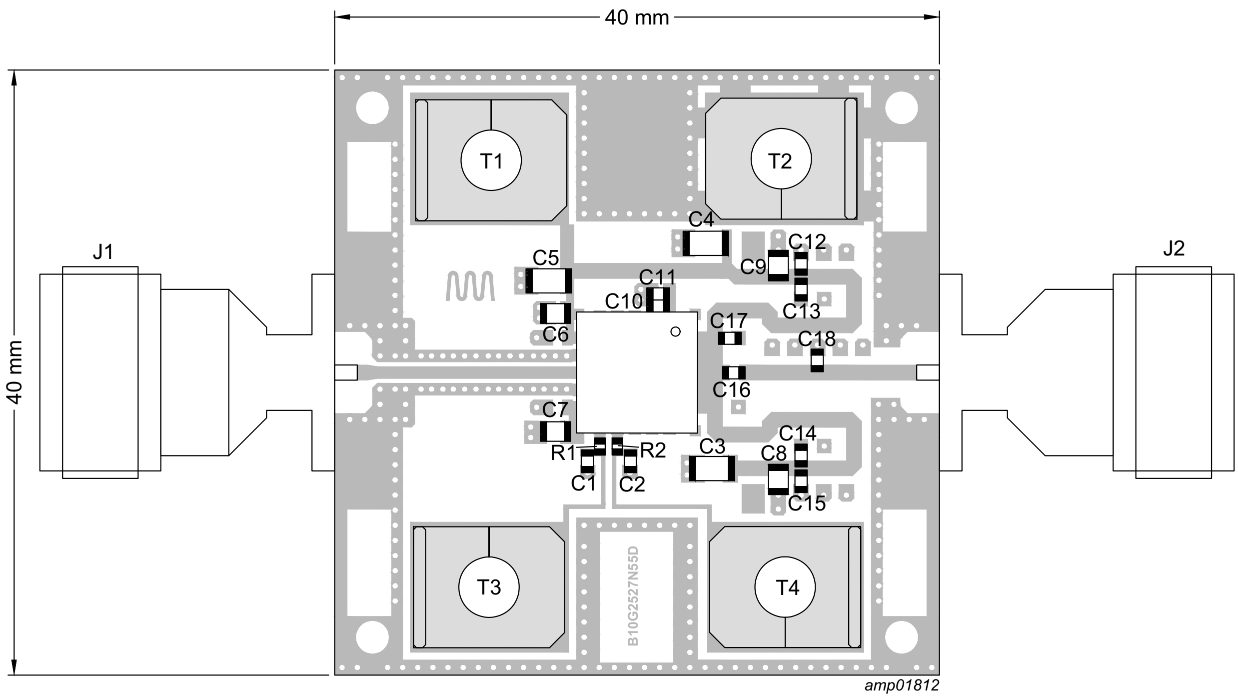
[1] Pulsed CW power sweep measurement (δ = 10 %; t_p = 100 μs).

[2] 25 ms CW power sweep measurement.

[3] Set to obtain IMD3 = −32 dBc.

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

8.2 PCB layout and electrical schematic



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

Fig 3. Component layout

Table 9. Demo test circuit list of components

See Figure 3 for component layout.

Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	4.7 μF, 6.3 V	Murata: GRM155R60J475ME47D
C3, C4, C5	multilayer ceramic chip capacitor	10 μF, 50 V	Murata: GRM21BR6YA106KE43
C6,C7,C8,C9	multilayer ceramic chip capacitor	1 μF, 50 V	Murata: C1608X5R1H105K080AB
C10, C11, C12, C13, C14, C15	multilayer ceramic chip capacitor	100 nF, 50 V	Murata: 06035C104KAT2A
C16	multilayer ceramic chip capacitor	6.8 pF, ± 0.1 %	Murata: GQM1875C2E6R8BB12
C17	multilayer ceramic chip capacitor	0.5 pF, ± 0.1 %	Murata: GQM1875C2E0R5BB12
C18	multilayer ceramic chip capacitor	0.9 pF, ± 0.1 %	Murata: GQM1875C2E0R9BB12
R1, R2	resistor	1 kΩ, ± 1 %, 100 mW	Multicomp Pro: MCSR06X1001FTL
J1	N Coaxial panel connector male		Radiall: R161.438.200
J2	N Coaxial panel connector female		Huber & Suhner: 23_N-50-0-16/133_NE
T1, T2, T3, T4	PCB terminal	6.35 mm x 0.81 mm, 4.1 mm	TE connectivity: 141879-1

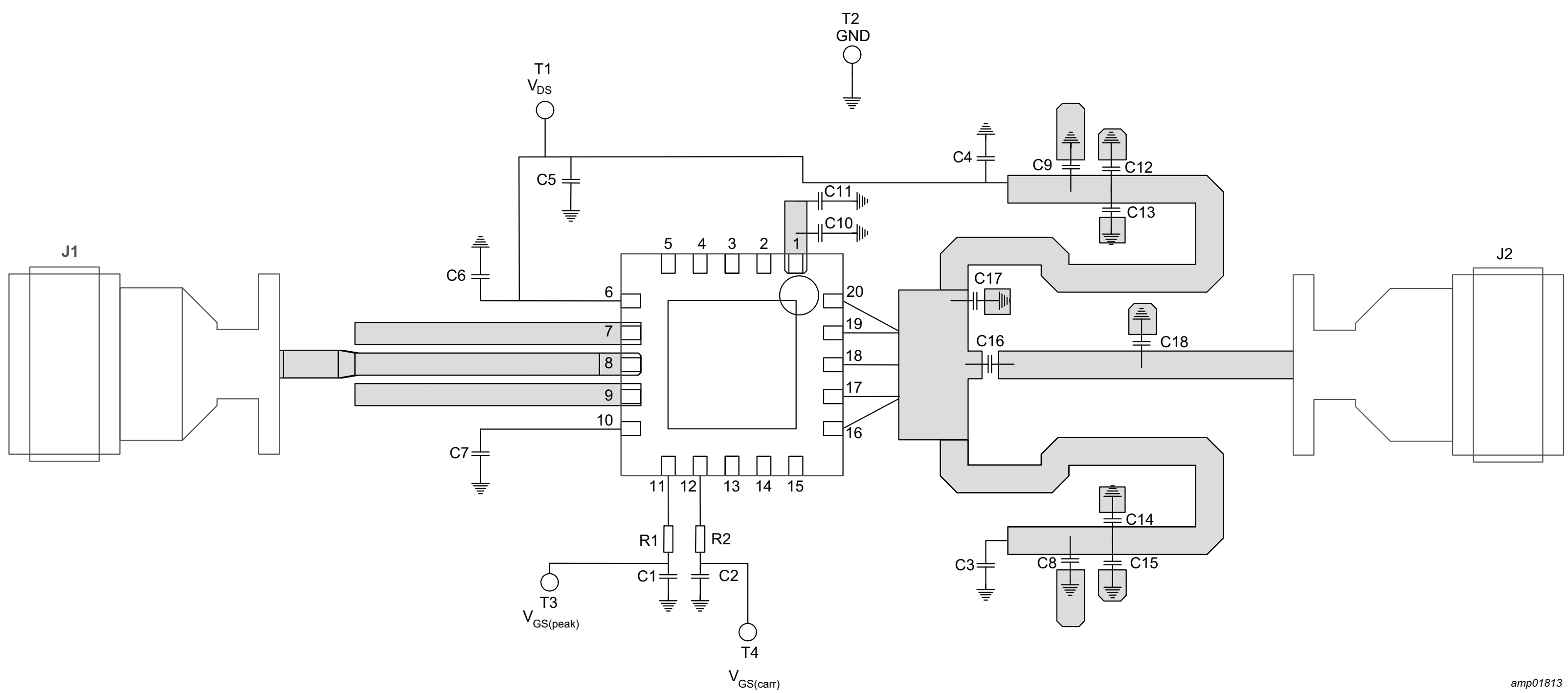


Fig 4. Electrical schematic

8.3 Ruggedness in a Doherty operation

8.3.1 Output mismatch ruggedness

The B10G2327N55D is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 32 V; I_{Dq} = 49 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.31$ V; P_i corresponding to $P_{L(3dB)}$ – 9 dB under Z_S = 50 Ω load; f = 2700 MHz (1-carrier W-CDMA; PAR = 9.9 dB); T_{case} = 25 °C.

8.3.2 Wideband noise ruggedness

The B10G2327N55D is capable of withstanding an AWGN (Additive White Gaussian Noise) with 11.2 dB PAR, OBW (Occupied BandWidth) of 800 MHz, under the following conditions: V_{DS} = 32 V; I_{Dq} = 49 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.31$ V; 3 dB P_i overdrive from $P_{L(AV)}$ = 34 dBm; f = 2600 MHz as central frequency; T_{case} = 25 °C.

8.4 Impedance information

Table 10. Typical impedance for optimum Doherty operation for 2.3 GHz to 2.4 GHz band

Measured load-pull data; test signal: pulsed CW; T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 48 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.25$ V; t_p = 100 μs; δ = 10 %.

	tuned for optimum Doherty operation				
f	Z_L [1]	$P_{L(1dB)}$	$G_{p(max)}$	η_{add} [2]	η_{add} [3]
(MHz)	(Ω)	(dBm)	(dB)	(%)	(%)
2200	11.6 – j10.9	45.9	30.17	45.15	30.45
2300	14.0 – j9.5	46.0	30.39	47.35	32.40
2400	17.0 – j11.5	46.1	30.50	49.50	32.50

[1] Reference package plane.

[2] At $P_{L(1dB)}$.

[3] At 34 dBm.

Table 11. Typical impedance for optimum Doherty operation for 2.5 GHz to 2.7 GHz band

Measured load-pull data; test signal: pulsed CW; T_{case} = 25 °C; V_{DS} = 28 V; I_{Dq} = 49 mA (carrier); $V_{GSq(peaking)} = V_{GSq(carrier)} - 0.31$ V; t_p = 100 μs; δ = 10 %.

	tuned for optimum Doherty operation				
f	Z_L [1]	$P_{L(1dB)}$	$G_{p(max)}$	η_{add} [2]	η_{add} [3]
(MHz)	(Ω)	(dBm)	(dB)	(%)	(%)
2500	16.9 – j11.6	46.2	30.1	53.8	36.8
2600	16.4 – j7.9	46.4	30.2	56.0	37.6
2700	15.5 – j4.9	46.3	30.4	57.3	36.7
2800	14.4 – j4.5	46.0	29.9	57.2	35.8

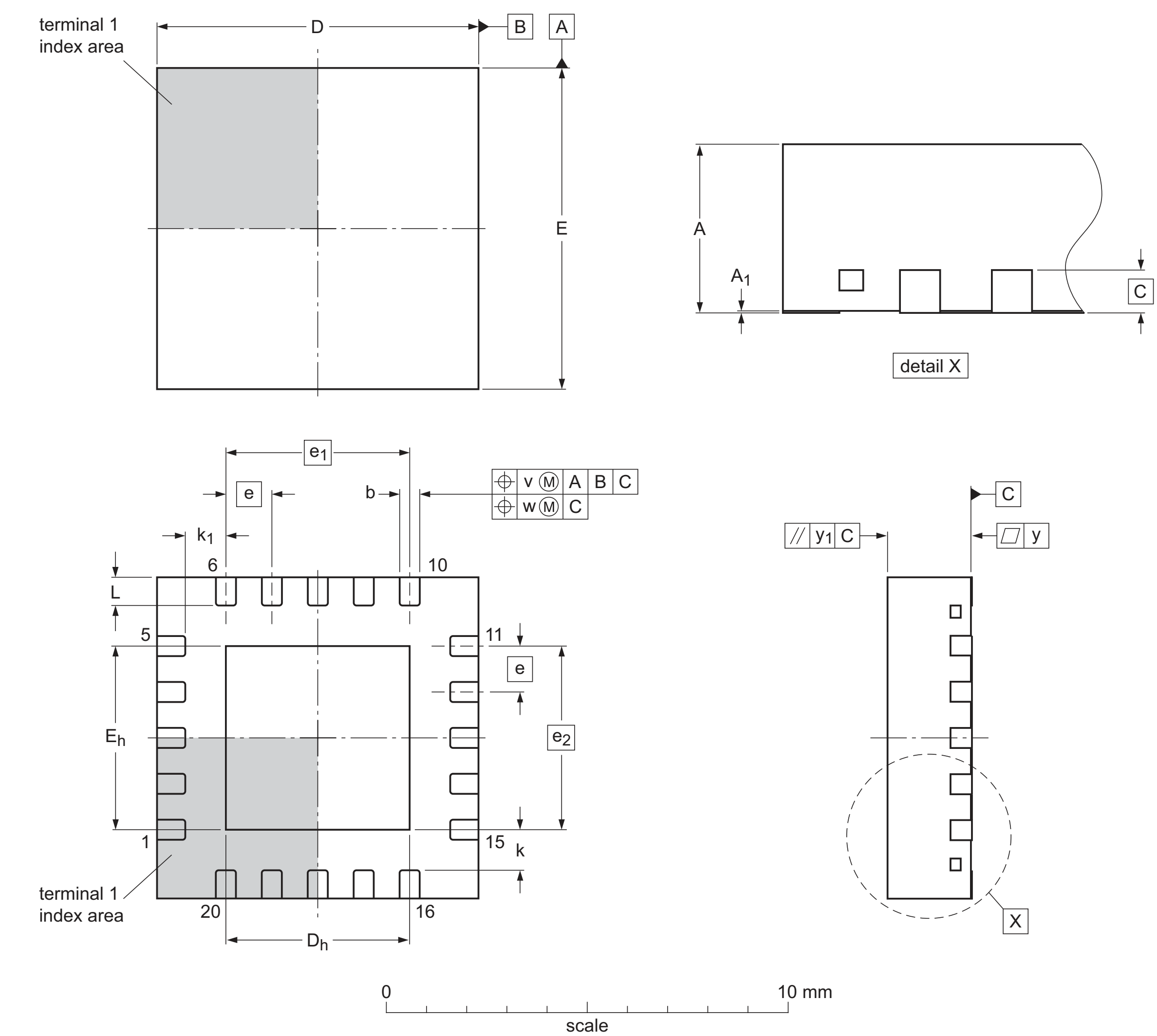
[1] Reference package plane.

[2] At $P_{L(1dB)}$.

[3] At 34 dBm.

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**



Dimensions

Unit		$A^{(1)}$	A_1	b	C	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	e_2	k	k_1	L	v	w	y	y_1
	max	2.20	0.05	0.60		8.1	4.72	8.1	4.72						0.8				
mm	nom	2.10		0.50	0.508	8.0	4.62	8.0	4.62	1.15	4.6	4.6			0.7	0.1	0.05	0.1	0.1
	min	2.00	0.00	0.40		7.9	4.52	7.9	4.52				0.99	0.99	0.6				

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1462-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1462-1						~~15-10-12~~ 17-06-23

Fig 5. 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 12. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2B [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1C [2]

[1] CDM classification C2B is granted to any part that passes after exposure to an ESD pulse of 750 V.

[2] HBM classification 1C is granted to any part that passes after exposure to an ESD pulse of 1000 V.

11. Abbreviations

Table 13. Abbreviations

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
ESD	ElectroStatic Discharge
GSM	Global System for Mobile Communications
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LTE	Long Term Evolution
MMIC	Monolithic Microwave Integrated Circuit
mMIMO	massive Multiple Input Multiple Output
MTF	Median Time to Failure
OBO	Output Back Off
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

12. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
B10G2327N55D v.1	20221011	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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