BLC8G20LS-310AV

Power LDMOS transistor

Rev. 3 — 1 September 2015

AMPLEON

Product data sheet

1. Product profile

1.1 General description

310 W LDMOS packaged asymmetric Doherty power transistor for base station applications at frequencies from 1900 MHz to 2000 MHz.

Table 1. Typical performance

Typical RF performance at T_{case} = 25 °C in an asymmetrical Doherty production test circuit. V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V, unless otherwise specified.

Test signal	f	V_{DS}	$P_{L(AV)}$	G_p	η_D	ACPR
	(MHz)	(V)	(dBm)	(dB)	(%)	(dBc)
1-carrier W-CDMA	1930 to 1995	28	47.5	17	42.5	–33 [1]

[1] Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 9.65 dB at 0.01% probability on CCDF per carrier.

1.2 Features and benefits

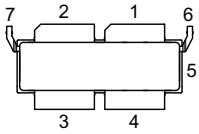
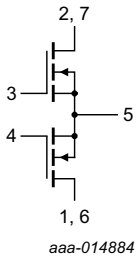
- Excellent ruggedness
- High-efficiency
- Low thermal resistance providing excellent thermal stability
- Lower output capacitance for improved performance in Doherty applications
- Designed for low memory effects providing excellent digital pre-distortion capability
- Internally matched for ease of use
- Integrated ESD protection
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- RF power amplifiers for base stations and multi carrier applications in the 1900 MHz to 2000 MHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain2 (peak)		
2	drain1 (main)		
3	gate1 (main)		
4	gate2 (peak)		
5	source [1]		
6	video decoupling (peak)		
7	video decoupling (main)		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLC8G20LS-310AV	-	air cavity plastic earless flanged package; 6 leads	SOT1258-3

4. 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
$V_{GS(amp)main}$	main amplifier gate-source voltage		−0.5	+13	V
$V_{GS(amp)peak}$	peak amplifier gate-source voltage		−0.5	+13	V
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature	[1]	-	225	°C

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the on-line MTF calculator.

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V; T_{case} = 80 °C		
		P_L = 56 W (CW)	0.30	K/W
		P_L = 89 W (CW)	0.30	K/W

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Main device						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 1.44 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 144 mA	1.5	1.9	2.3	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 650 mA	1.7	2.1	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	2.8	µA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	28	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	280	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 5.04 A	-	10	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 5.04 A	-	100	166	mΩ
Peak device						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 2.2 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 220 mA	1.5	1.9	2.3	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 1100 mA	1.7	2.1	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	2.8	µA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	39	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	280	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 7.70 A	-	15	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 7.7 A	-	70	112	mΩ

Table 7. RF characteristics

Test signal: 1-carrier W-CDMA; PAR = 9.65 dB at 0.01 % probability on the CCDF; 3GPP test model 1; 1 - 64 DPCH; f_1 = 1932.5 MHz; f_2 = 1992.5 MHz; RF performance at V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V; T_{case} = 25 °C; unless otherwise specified; in an asymmetrical Doherty production test circuit in 1930 MHz to 1995 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	$P_{L(AV)}$ = 56 W	15.8	16.9	-	dB
RL_{in}	input return loss	$P_{L(AV)}$ = 56 W	-	−10	−6	dB
η_D	drain efficiency	$P_{L(AV)}$ = 56 W	38	42.5	-	%
ACPR	adjacent channel power ratio	$P_{L(AV)}$ = 56 W	-	−33	−28	dBc

Table 8. RF characteristics

Test signal: 1-carrier W-CDMA; PAR = 9.65 dB at 0.01 % probability on the CCDF; 3GPP test model 1; 1 - 64 DPCH; RF performance at V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V; T_{case} = 25 °C; unless otherwise specified; in an asymmetrical Doherty production test circuit at 1992.5 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
PAR_O	output peak-to-average ratio	$P_{L(AV)}$ = 56 W	7.0	7.25	-	dB
$P_{L(M)}$	peak output power	$P_{L(AV)}$ = 56 W	281	300	-	W

7. Test information

7.1 Ruggedness in Doherty operation

The BLC8G20LS-310AV 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} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V; f = 1930 MHz. Test signal: 1-carrier WCDMA; P_L = 90 W ($P_{L(M)}$ = −5 dB); 100 % clipping at 0.01% probability on CCDF.

7.2 Impedance information

Table 9. Typical impedance of main device

Measured load-pull data of main device; I_{Dq} = 700 mA (main); V_{DS} = 28 V; pulsed CW (t_p = 100 μs; δ = 10 %).

f	Z_S [1]	Z_L [1]	P_L [2]	η_D [2]	G_p [2]
(MHz)	(Ω)	(Ω)	(W)	(%)	(dB)
Maximum power load					
1930	1.3 – j3.5	1.1 – j4.1	169.8	55.6	16.9
1962	1.4 – j3.9	1.1 – j4.1	166.3	56.0	17.3
1995	2.1 – j3.9	1.3 – j4.4	163.9	57.9	17.9
Maximum drain efficiency load					
1930	1.3 – j3.5	1.7 – j2.9	116.0	66.4	19.6
1962	1.4 – j3.9	1.8 – j3.3	121.2	65.6	19.7
1995	2.1 – j3.9	1.8 – j3.9	136.0	64.0	19.4

[1] Z_S and Z_L defined in Figure 1.

[2] at 3 dB gain compression.

Table 10. Typical impedance of peak device

Measured load-pull data of peak device; I_{Dq} = 1200 mA (peak); V_{DS} = 28 V; pulsed CW (t_p = 100 μs; δ = 10 %).

f	Z_S [1]	Z_L [1]	P_L [2]	η_D [2]	G_p [2]
(MHz)	(Ω)	(Ω)	(W)	(%)	(dB)
Maximum power load					
1930	1.1 – j3.9	1.4 – j4.7	239.9	53.9	16.5
1962	1.4 – j4.1	1.4 – j4.8	234.3	53.6	16.9
1995	1.8 – j4.5	1.4 – j5.2	229.3	50.2	16.6
Maximum drain efficiency load					
1930	1.1 – j3.9	1.7 – j2.9	149.8	64.3	19.6
1962	1.4 – j4.1	1.7 – j2.8	122.0	61.3	20.3
1995	1.8 – j4.5	1.7 – j3.3	147.6	62.9	19.9

[1] Z_S and Z_L defined in Figure 1.

[2] at 3 dB gain compression.

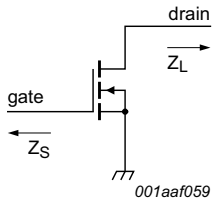


Fig 1. Definition of transistor impedance

7.3 Recommended impedances for Doherty design

Table 11. Typical impedance of main device at 1 : 1 load

Measured load-pull data of main device; I_{Dq} = 700 mA (main); V_{DS} = 28 V; pulsed CW (t_p = 100 μs; δ = 10 %).

f	Z_S [1]	Z_L [1]	P_L [2]	η_D [3]	G_p [3]
(MHz)	(Ω)	(Ω)	(dBm)	(%)	(dB)
Maximum power load					
1930	0.9 – j3.3	1.3 – j4.8	151.7	33.9	19.8
1962	0.9 – j3.6	1.3 – j4.6	152.8	35.2	20.2
1995	1.3 – j3.7	1.3 – j4.5	162.5	36.2	20.6

[1] Z_S and Z_L defined in Figure 1.

[2] at 3 dB gain compression.

[3] at $P_{L(AV)}$ = 56 W.

Table 12. Typical impedance of main device at 1 : 2.5 load

Measured load-pull data of main device; I_{Dq} = 700 mA (main); V_{DS} = 28 V; pulsed CW (t_p = 100 μs; δ = 10 %).

f	Z_S [1]	Z_L [1]	P_L [2]	η_D [3]	G_p [3]
(MHz)	(Ω)	(Ω)	(dBm)	(%)	(dB)
Maximum power load					
1930	1.3 – j3.4	2.4 – j3.5	111.2	49.2	22.5
1962	1.4 – j3.8	2.6 – j3.5	105.7	50.4	22.9
1995	1.9 – j3.9	2.8 – j3.6	100.2	50.2	23.0

[1] Z_S and Z_L defined in Figure 1.

[2] at 3 dB gain compression.

[3] at $P_{L(AV)}$ = 56 W.

Table 13. Typical impedance of peak device at 1 : 1 load

Measured load-pull data of peak device; I_{Dq} = 1200 mA (peak); V_{DS} = 28 V; pulsed CW (t_p = 100 μs; δ = 10 %).

f	Z_S [1]	Z_L [1]	P_L [2]	η_D [2]	G_p [2]
(MHz)	(Ω)	(Ω)	(dBm)	(%)	(dB)
Maximum power load					
1930	1.1 – j4.9	1.7 – j4.9	231.2	51.9	16.6
1962	1.4 – j4.1	1.6 – j4.7	217.8	53.0	17.3
1995	1.8 – j4.4	1.6 – j4.5	215.3	57.1	17.9

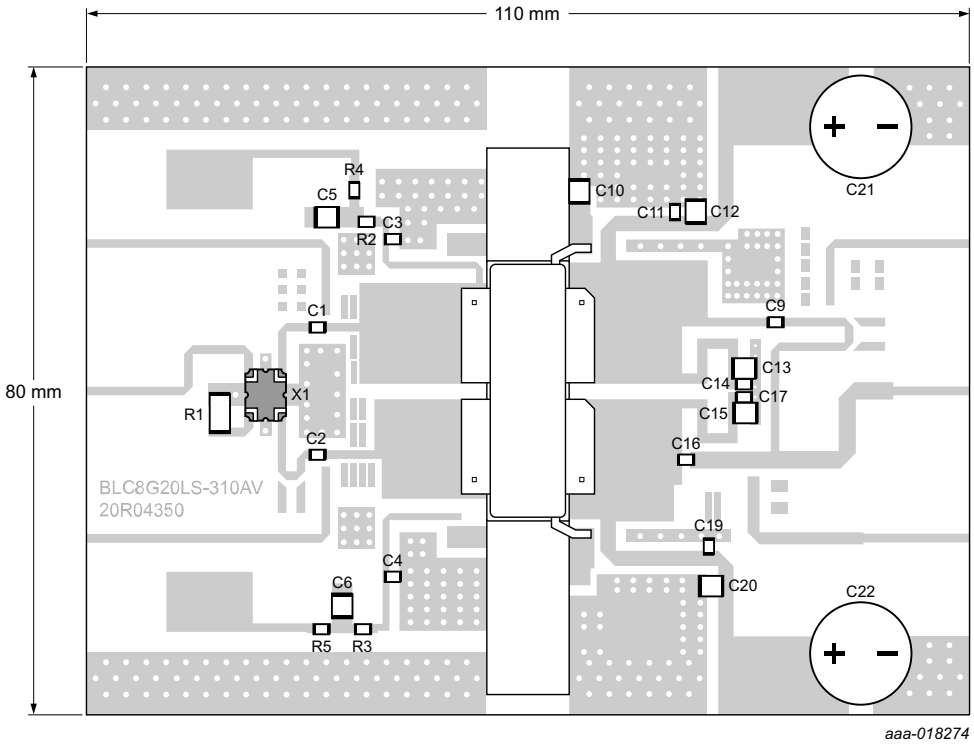
[1] Z_S and Z_L defined in Figure 1.

[2] at 3 dB gain compression.

Table 14. Off-state impedances of peak device

f	Z_{off}
(MHz)	(Ω)
1930	0.6 + j1.9
1962	0.6 + j2.2
1995	0.6 + j2.5

7.4 Test circuit



Printed-Circuit Board (PCB): Rogers RO4350B; thickness = 0.508 mm; thickness copper plating = 35 μm. See Table 15 for a list of components.

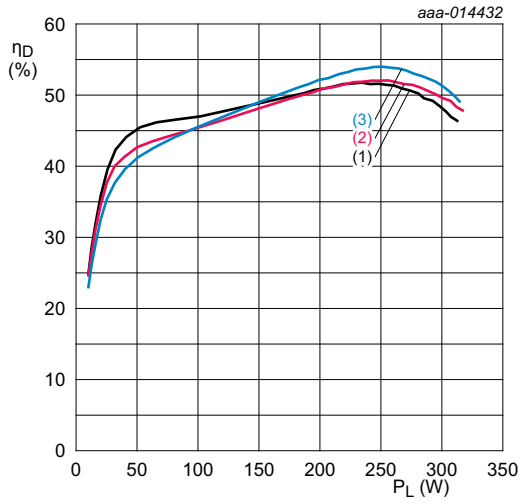
Fig 2. Component layout for test circuit

Table 15. List of components
See Figure 2 for component layout.

Component	Description	Value	Remarks
C1, C2, C3, C4, C9, C11, C14, C16, C17, C19	multilayer ceramic chip capacitor	18 pF	Murata 0805
C5, C6, C10, C12, C13, C15, C20	multilayer ceramic chip capacitor	10 μF	
C21, C22	electrolytic capacitor	470 μF, 63 V	
C6	multilayer ceramic chip capacitor	2.4 pF	
R1	SMD resistor	50 Ω, 12 W	Anaren 2010
R2, R3	wire resistor	5.1 Ω	Vishay Dale 0805
R4	wire resistor	1.2 kΩ	SMD 0805
R5	wire resistor	3.9 kΩ	SMD 0805

7.5 Graphical data

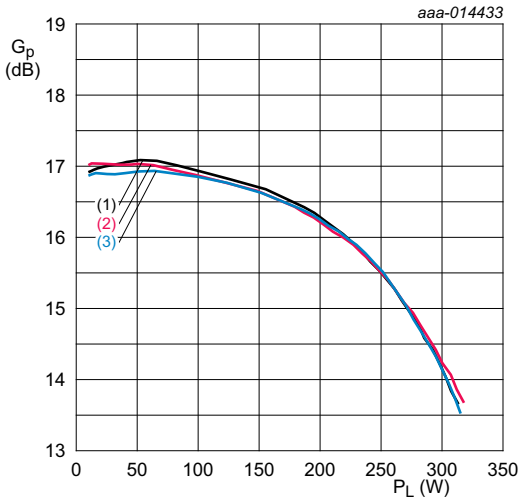
7.5.1 Pulsed CW



V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V; t_p = 100 μs; δ = 10 %.

(1) f = 1930 MHz
(2) f = 1962.5 MHz
(3) f = 1995 MHz

Fig 3. Drain efficiency as a function of output power; typical values



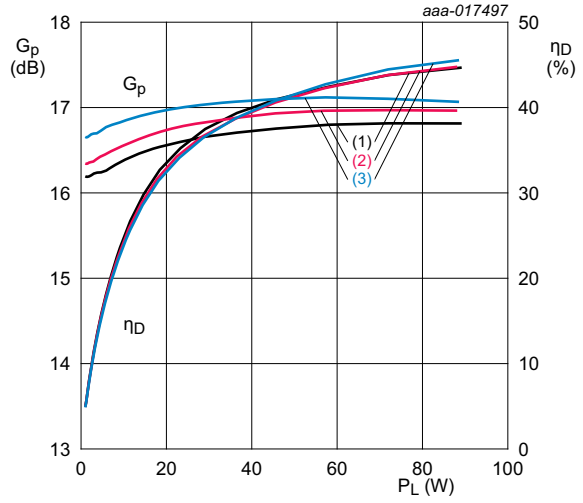
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V; t_p = 100 μs; δ = 10 %.

(1) f = 1930 MHz
(2) f = 1962.5 MHz
(3) f = 1995 MHz

Fig 4. Power gain as a function of output power; typical values

7.5.2 1-Carrier W-CDMA

PAR = 9.7 dB at 0.01 % probability on the CCDF; 3GPP test model 1 with 64 DPCH (100 % clipping).



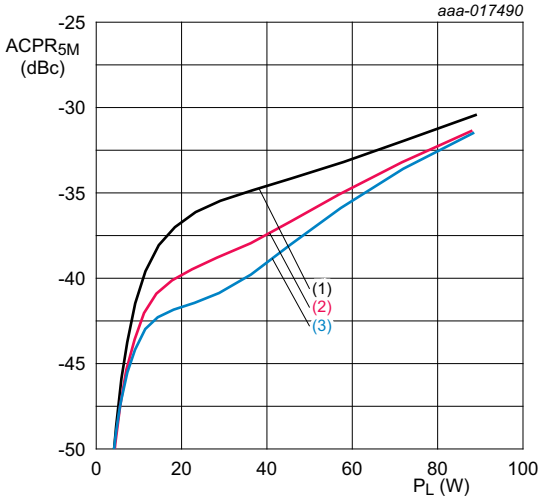
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

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



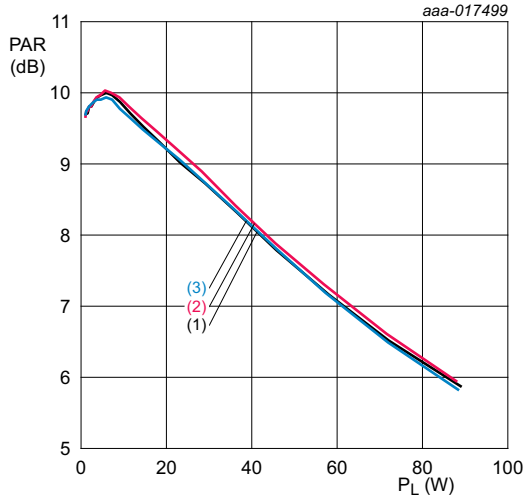
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

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



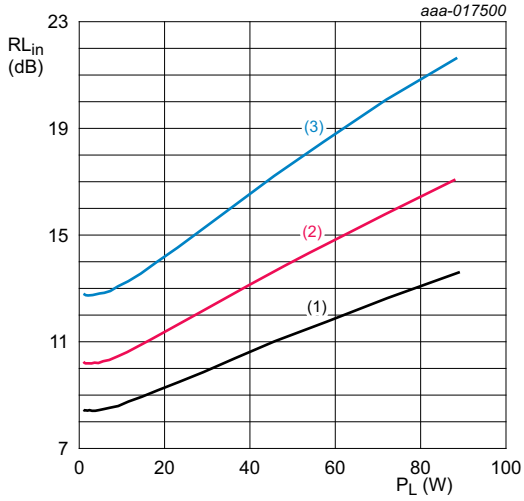
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

Fig 7. Peak-to-average ratio as a function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

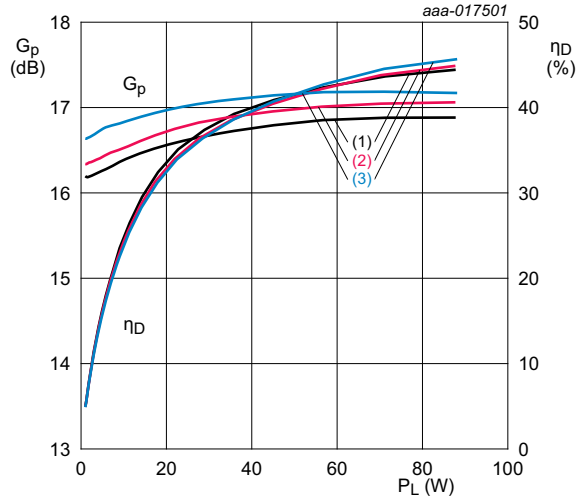
(2) f = 1962.5 MHz

(3) f = 1995 MHz

Fig 8. Input return loss as a function of output power; typical values

7.5.3 2-Carrier W-CDMA

PAR = 8.4 dB at 0.01 % probability on the CCDF; 3GPP test model 1 with 64 DPCH (46 % clipping).



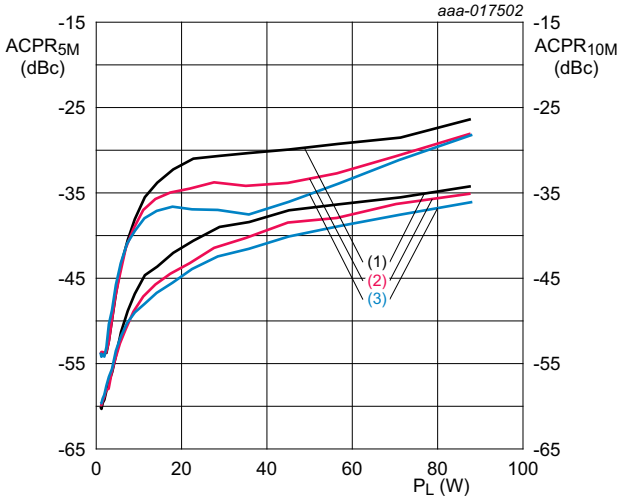
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

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



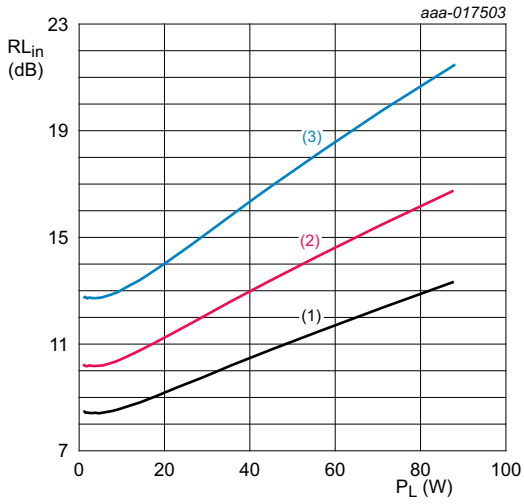
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

Fig 10. Adjacent channel power ratio (5 MHz) and adjacent channel power ratio (10 MHz) as function of output power; typical values



V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

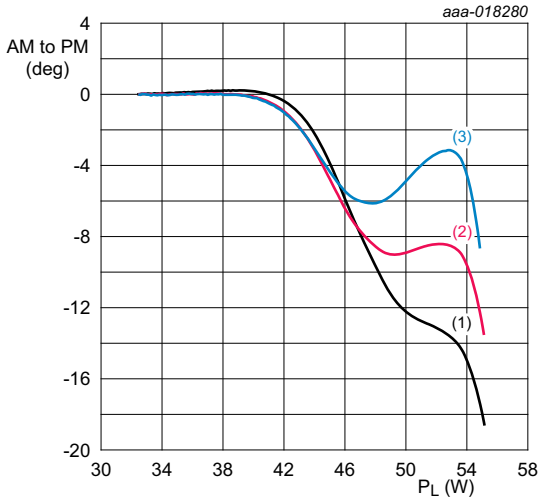
(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

Fig 11. Input return loss as a function of output power; typical values

7.5.4 CW



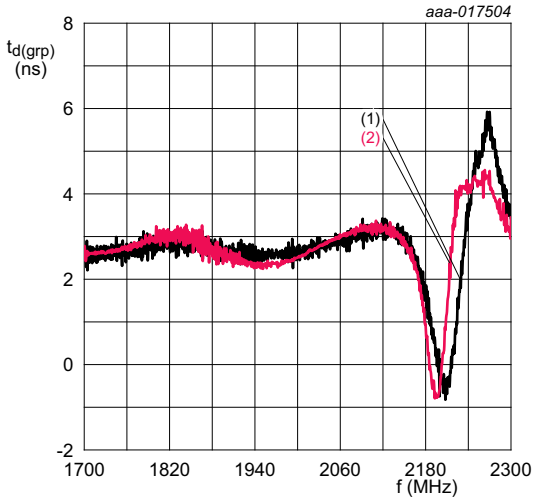
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) f = 1930 MHz

(2) f = 1962.5 MHz

(3) f = 1995 MHz

Fig 12. AM to PM as a function of output power; typical values



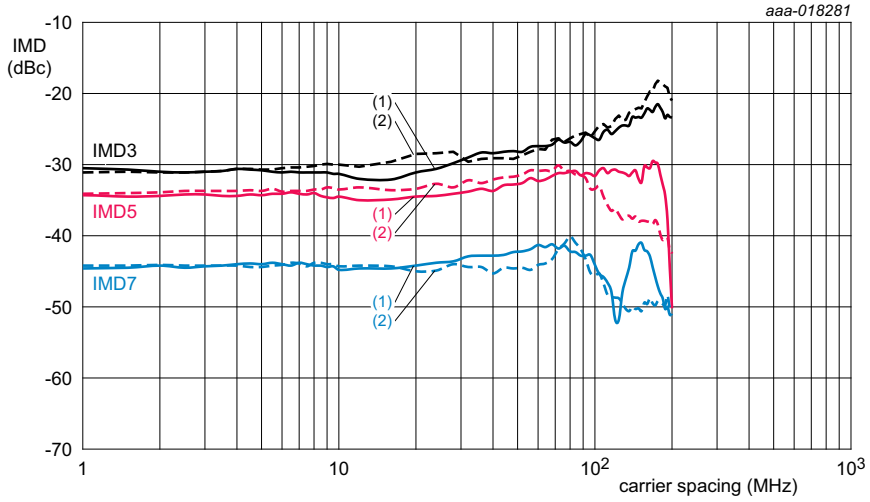
V_{DS} = 28 V; I_{Dq} = 650 mA (main); $V_{GS(amp)peak}$ = 0.5 V.

(1) P_i = −7 dBm

(2) P_i = +30.5 dBm

Fig 13. Group delay time as a function of frequency; typical values

7.5.5 2-Tone VBW



V_{DS} = 28 V; I_{Dq} = 450 mA (main); $V_{GS(amp)peak}$ = 0.5 V; f = 1960 MHz.

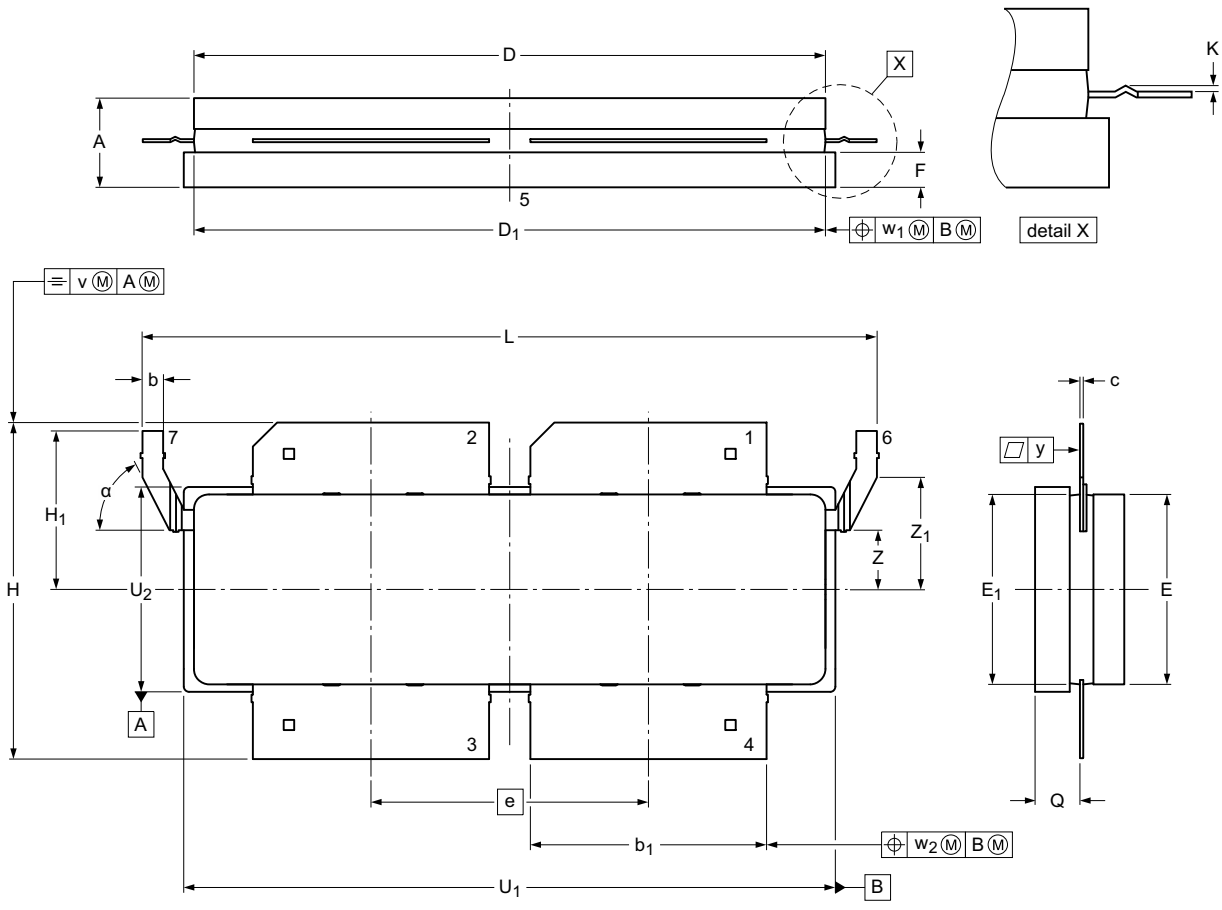
(1) IMD low

(2) IMD high

Fig 14. VBW capability in Doherty development board

8. Package outline

Air cavity plastic earless flanged package; 6 leads **SOT1258-3**



K	y	α	Z	Z_1
0.17	0.1	65°	3.17	5.79
		61°	2.67	5.29

Dimensions (mm are the original dimensions)

Unit[1]		A	b	b_1	c	D	D_1	E	E_1	e	L	F	H	H_1	Q	U_1	U_2	v	w_2	w_2
mm	max	4.65	1.12	11.78	0.2	31.44	31.34	9.60	9.50		36.42	1.83	16.71	8.12	2.33	32.33	10.23			
	nom									13.72								0.5	0.5	0.5
	min	4.18	0.91	11.58	0.1	31.04	31.14	9.20	9.30		36.22	1.63	16.51	7.62	2.13	32.13	10.03			

sot1258-3_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1258-3						~~14-12-01~~ 14-12-19

Fig 15. Package outline SOT1258-3

9. 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.

10. Abbreviations

Table 16. Abbreviations

Acronym	Description
3GPP	3rd Generation Partnership Project
AM	Amplitude Modulation
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
DPCH	Dedicated Physical CHannel
ESD	ElectroStatic Discharge
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
PAR	Peak-to-Average Ratio
PM	Phase Modulation
SMD	Surface Mounted Device
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

11. Revision history

Table 17. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLC8G20LS-310AV#3	20150901	Product data sheet	-	BLC8G20LS-310AV v.2
Modifications:	• The format of this document has been redesigned to comply with the new identity guidelines of Ampleon. • Legal texts have been adapted to the new company name where appropriate.			
BLC8G20LS-310AV v.2	20150506	Product data sheet	-	BLC8G20LS-310AV v.1
BLC8G20LS-310AV v.1	20150506	Product data sheet	-	-

12. Legal information

12.1 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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13. Contact information

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For sales office addresses, please visit:
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