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# BLC9G20LS-120VT

Power LDMOS transistor

Rev. 2 — 5 July 2018

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

120 W LDMOS power transistor with enhanced video bandwidth for base station applications at frequencies from 1805 MHz to 1995 MHz.

**Table 1. Typical performance**

*Typical RF performance at  $T_{case} = 25^{\circ}C$  in a common source class-AB production test circuit.*

Test signal	f	$I_{Dq}$	$V_{DS}$	$P_{L(AV)}$	$G_p$	$\eta_D$	ACPR <sub>5M</sub>
	(MHz)	(mA)	(V)	(W)	(dB)	(%)	(dBc)
2-carrier W-CDMA	1805 to 1880	700	28	30	18.5	31	-31 <sup>[1]</sup>

[1] Test signal: 3GPP test model 1; 64 DPCH; PAR = 8.4 dB at 0.01 % probability on CCDF per carrier; 5 MHz carrier spacing.

### 1.2 Features and benefits

- Excellent ruggedness
- High efficiency
- Low thermal resistance providing excellent thermal stability
- Decoupling leads to enable enhanced video bandwidth performance (75 MHz typical)
- Designed for broadband operation (1805 MHz to 1995 MHz)
- Lower output capacitance for improved performance in Doherty applications
- Designed for low memory effects providing excellent pre-distortability
- Internally matched for ease of use
- Integrated ESD protection
- For RoHS compliance see the product details on the Ampleon website

### 1.3 Applications

- RF power amplifiers for base stations and multi carrier applications in the 1805 MHz to 1995 MHz frequency range

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain		
2	gate		
3	source <sup>[1]</sup>		
4	video decoupling		
5	video decoupling		
6	n.c.		
7	n.c.		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLC9G20LS-120VT	-	air cavity plastic earless flanged package; 6 leads	SOT1271-2

## 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
$V_{GS}$	gate-source voltage		-6	+13	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature <sup>[1]</sup>		-	225	°C

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

## 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_{case} = 80\text{ °C}; P_L = 30\text{ W}$	0.47	K/W

## 6. Characteristics

**Table 6. DC characteristics**

$T_j = 25\text{ }^\circ\text{C}$  per section, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 1.2\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 120\text{ mA}$	1.5	1.9	3.1	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 700\text{ mA}$	-	2.2	-	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 32\text{ V}$	-	-	2.8	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$	-	25	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$	-	-	280	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 6\text{ A}$	-	4.3	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 4.2\text{ A}$	-	0.12	-	$\Omega$

**Table 7. RF characteristics**

Test signal: 2-carrier W-CDMA; 3GPP test model 1 with 64 DPCH; PAR = 8.4 dB at 0.01 % probability on the CCDF;  $f_1 = 1807.5\text{ MHz}; f_2 = 1812.5\text{ MHz}; f_3 = 1872.5\text{ MHz}; f_4 = 1877.5\text{ MHz}$ ; RF performance at  $V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}; T_{case} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified; in a water cooled class-AB test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_{L(AV)} = 30\text{ W}$	17.8	18.5	-	dB
$\eta_D$	drain efficiency	$P_{L(AV)} = 30\text{ W}$	29	31	-	%
$RL_{in}$	input return loss	$P_{L(AV)} = 30\text{ W}$	-	-14	-9	dB
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	$P_{L(AV)} = 30\text{ W}$	-	-31	-29	dBc

**Table 8. RF characteristics**

Test signal: 1-carrier W-CDMA; PAR = 7.5 dB at 0.01 % probability on the CCDF; 3GPP test model 1; 1 to 64 DPCH; RF performance at  $V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}; T_{case} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified; in a class-AB test circuit at a frequency of 1877.5 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$PAR_O$	output peak-to-average ratio	$P_{L(AV)} = 59\text{ W}$	4.00	4.67	-	dB
$P_{L(M)}$	peak output power	$P_{L(AV)} = 59\text{ W}$	145	172	-	W

## 7. Test information

### 7.1 Ruggedness in class-AB operation

The BLC9G20LS-120VT is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}; P_L = 100\text{ W (CW)}; f = 1805\text{ MHz}$ .

## 7.2 Impedance information

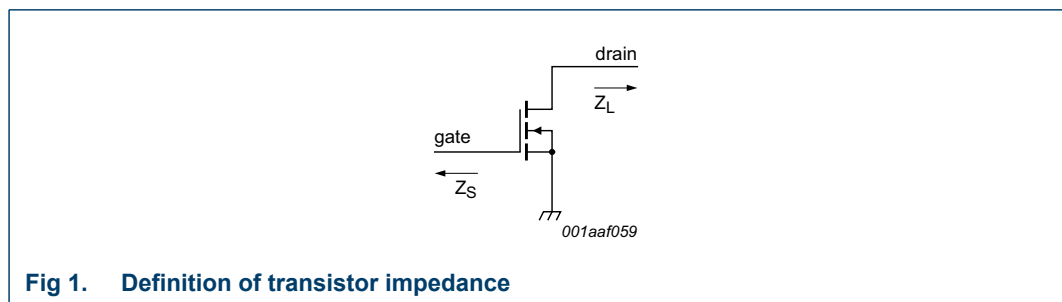
**Table 9. Typical impedance of device**

Measured load-pull data of device;  $I_{DQ} = 700 \text{ mA}$ ;  $V_{DS} = 28 \text{ V}$ ; pulsed CW ( $t_p = 100 \mu\text{s}$ ;  $\delta = 10 \%$ ).

f	$Z_S$ [1]	$Z_L$ [1]	$P_L$ [2]	$\eta_D$ [2]	$G_p$ [2]
(MHz)	( $\Omega$ )	( $\Omega$ )	(W)	(%)	(dB)
<b>Maximum power load</b>					
1805	1.1 – j5.7	1.3 – j2.9	189.6	61.8	15.7
1840	1.4 – j6.2	1.3 – j2.9	191.7	63.1	15.8
1880	1.8 – j6.7	1.3 – j2.9	189.9	61.6	16.0
1930	2.7 – j7.8	1.3 – j3.2	185.6	61.3	16.0
1960	3.8 – j8.4	1.3 – j3.2	182.3	61.2	16.5
1990	5.4 – j9.1	1.3 – j3.2	180.4	61.6	16.7
<b>Maximum drain efficiency load</b>					
1805	1.1 – j5.7	2.6 – j1.7	129.2	73.6	18.3
1840	1.4 – j6.2	2.6 – j1.7	127.3	74.7	18.6
1880	1.8 – j6.7	2.2 – j1.8	133.3	74.2	18.5
1930	2.7 – j7.8	2.2 – j1.8	123.5	72.8	19.0
1960	3.8 – j8.4	2.0 – j2.1	135.1	72.1	18.8
1990	5.4 – j9.1	2.0 – j2.1	129.5	71.8	19.2

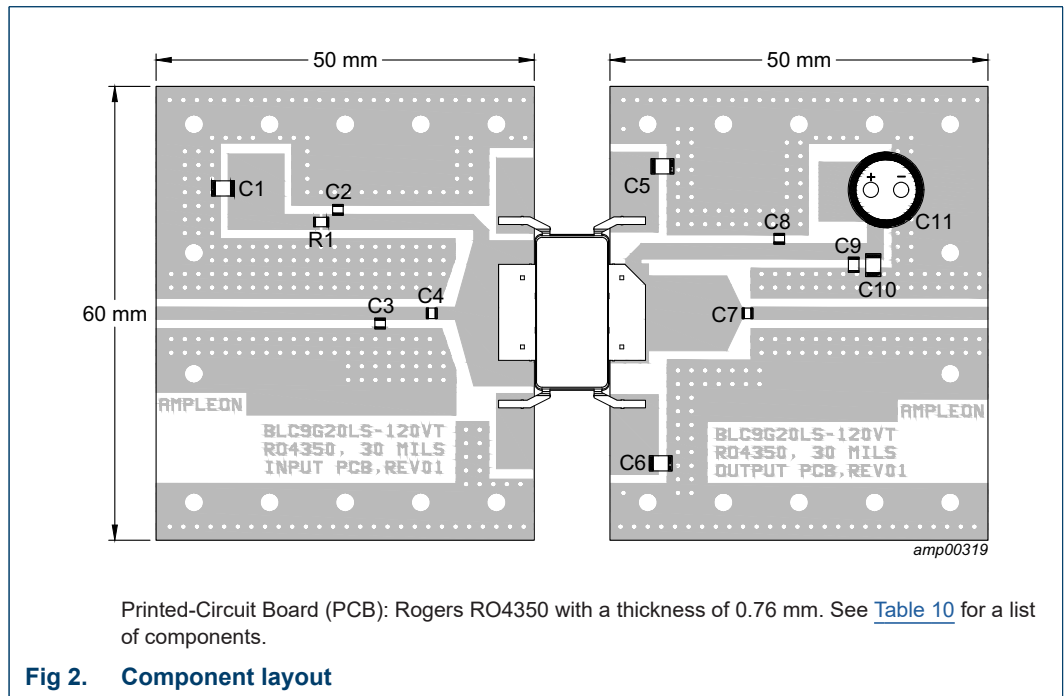
[1]  $Z_S$  and  $Z_L$  defined in Figure 1.

[2] At 3 dB gain compression.



**Fig 1. Definition of transistor impedance**

7.3 Test circuit



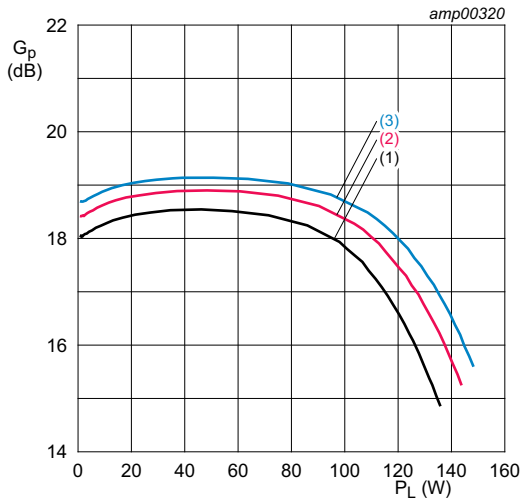
**Table 10. List of components**

See [Figure 2](#) for component layout.

Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	Murata
C2	multilayer ceramic chip capacitor	43 pF	ATC 800A
C3	multilayer ceramic chip capacitor	1.3 pF	ATC 800A
C4	multilayer ceramic chip capacitor	2.7 pF	ATC 800A
C5	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	Murata
C6	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	Murata
C7	multilayer ceramic chip capacitor	1.5 pF	ATC 800A
C8	multilayer ceramic chip capacitor	43 pF	ATC 800A
C9	multilayer ceramic chip capacitor	220 nF	Murata
C10	multilayer ceramic chip capacitor	4.7 $\mu$ F, 100 V	Murata
C11	electrolytic capacitor	470 $\mu$ F, 63 V	
R1	chip resistor	4.7 $\Omega$	SMD 0805

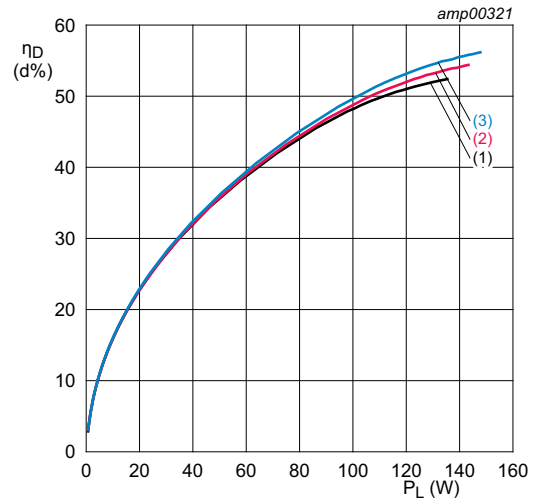
7.4 Graphical data

7.4.1 Pulsed CW



$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}; t_p = 100\text{ }\mu\text{s}; \delta = 10\text{ \%}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

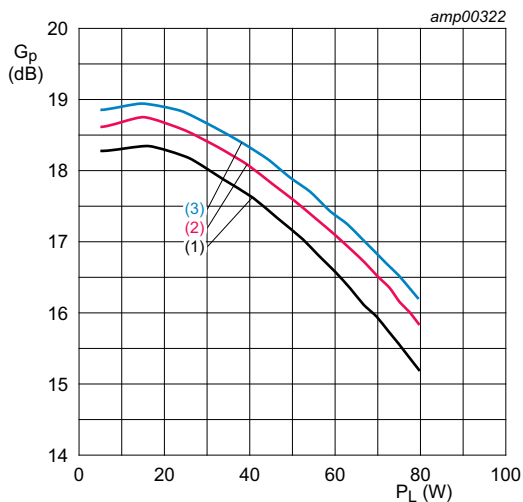
**Fig 3. Power gain as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}; t_p = 100\text{ }\mu\text{s}; \delta = 10\text{ \%}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

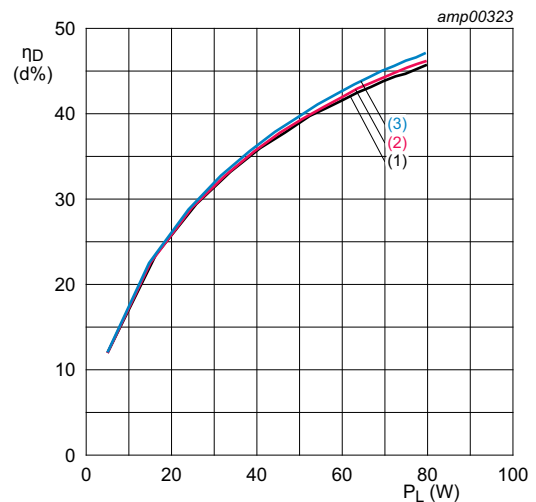
**Fig 4. Drain efficiency as a function of output power; typical values**

7.4.2 IS-95



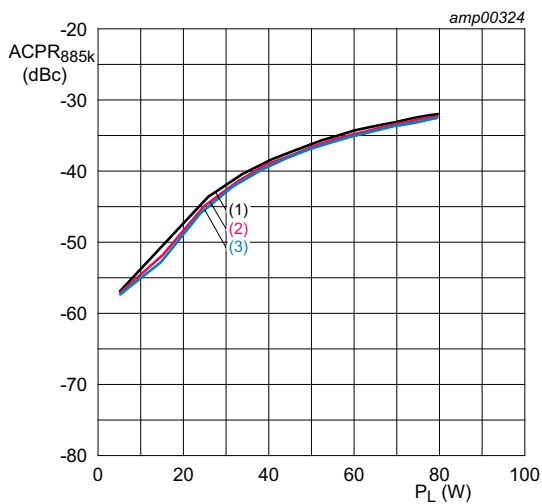
$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

**Fig 5. Power gain as a function of output power; typical values**



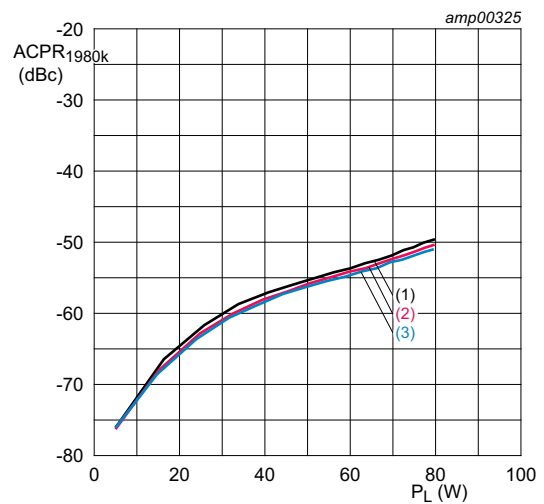
$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

**Fig 6. Drain efficiency as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

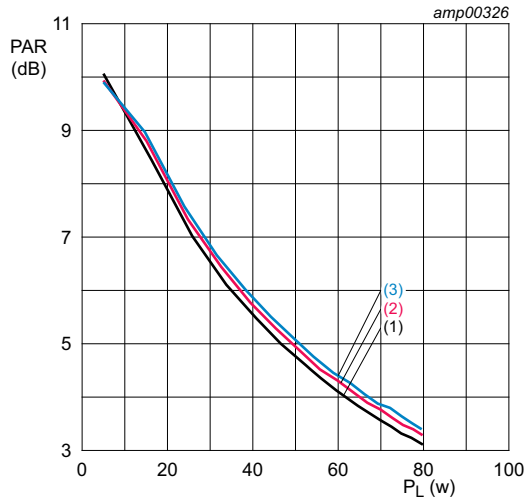
**Fig 7. Adjacent channel power ratio (885 kHz) as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

**Fig 8. Adjacent channel power ratio (1980 kHz) as a function of output power; typical values**



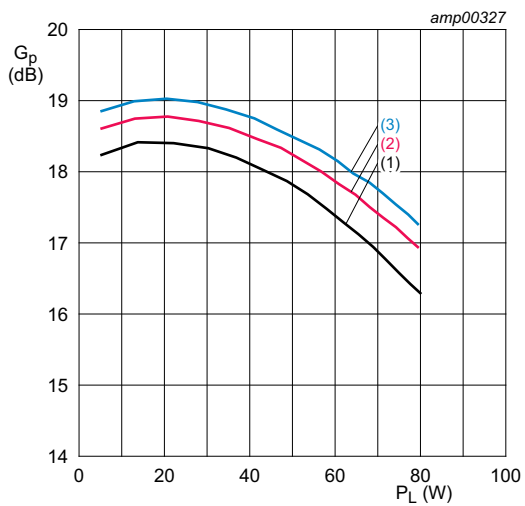


$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}$ .

- (1)  $f = 1810\text{ MHz}$
- (2)  $f = 1840\text{ MHz}$
- (3)  $f = 1875\text{ MHz}$

**Fig 9. Peak-to-average power ratio as a function of output power; typical values**

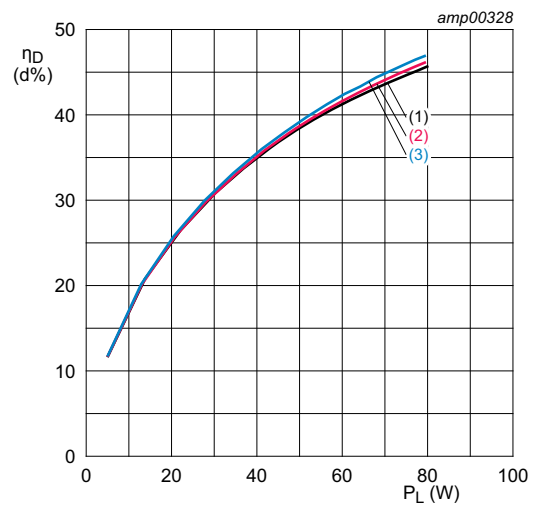
### 7.4.3 1-Carrier W-CDMA



$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}$ .

- (1)  $f = 1810\text{ MHz}$
- (2)  $f = 1840\text{ MHz}$
- (3)  $f = 1875\text{ MHz}$

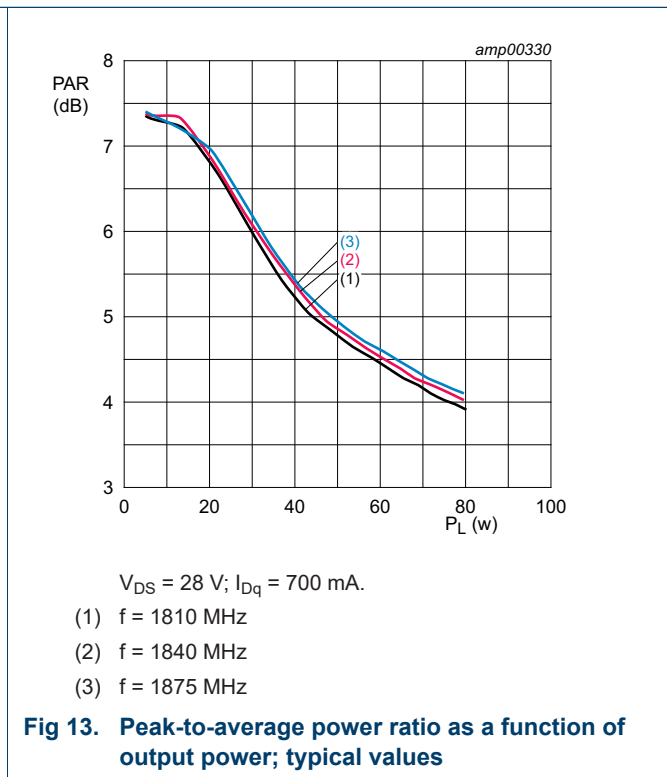
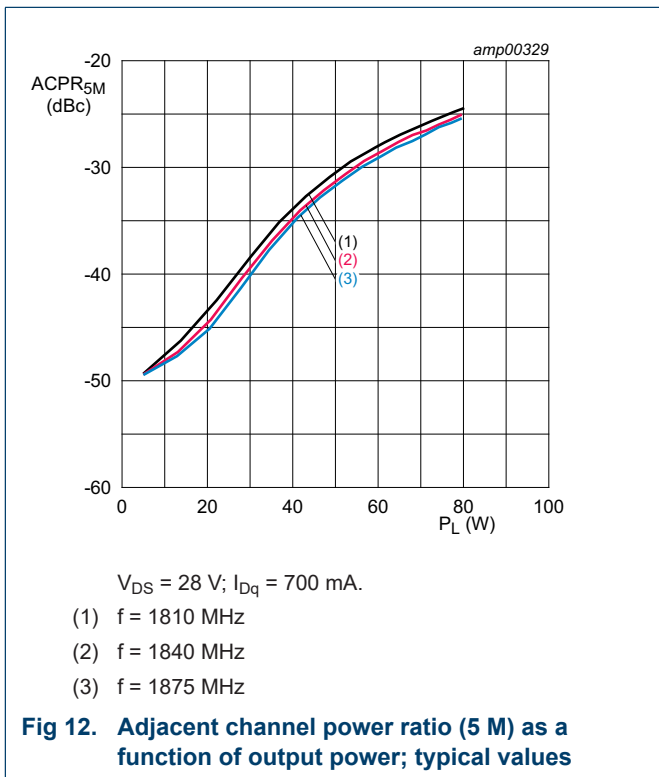
**Fig 10. Power gain as a function of output power; typical values**



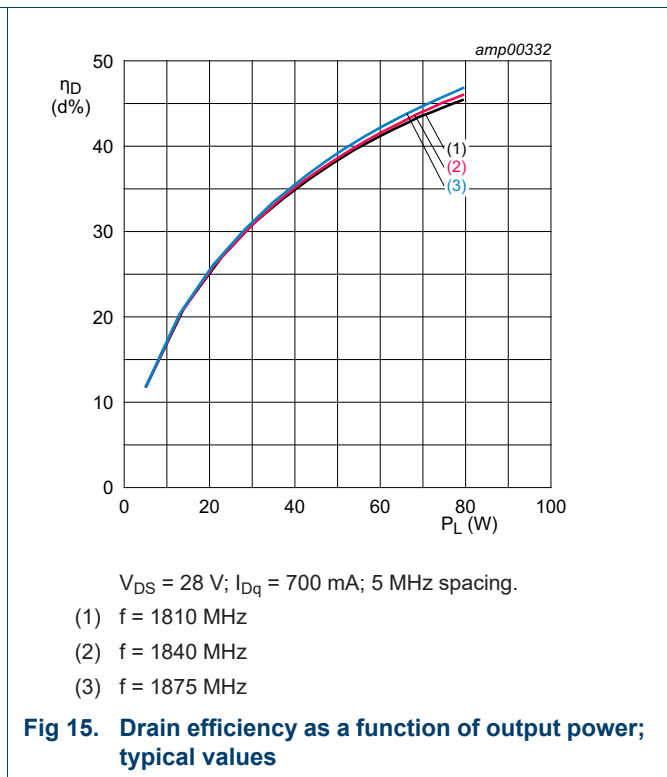
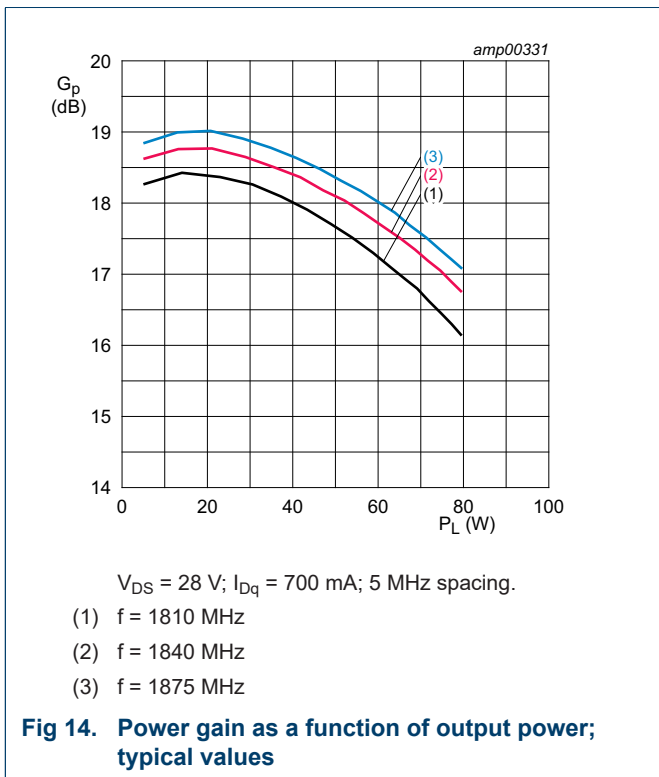
$V_{DS} = 28\text{ V}; I_{Dq} = 700\text{ mA}$ .

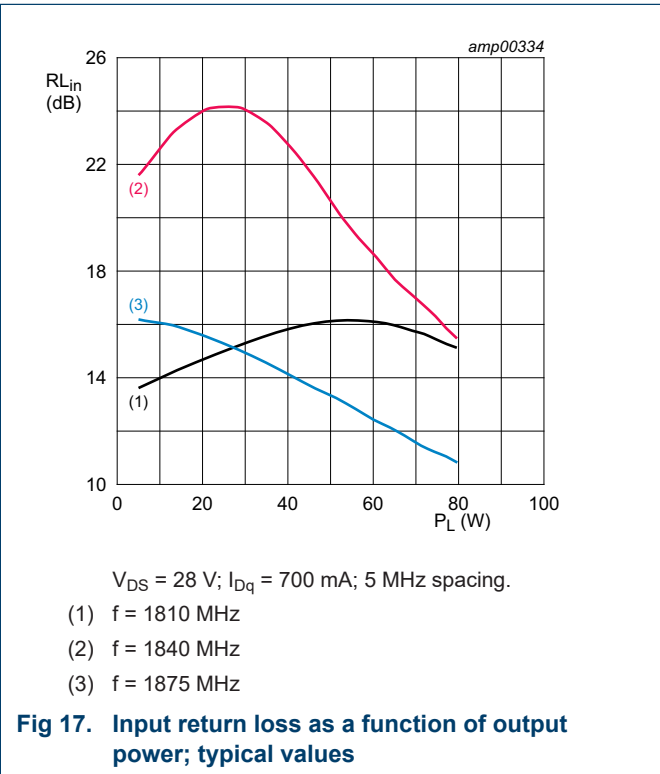
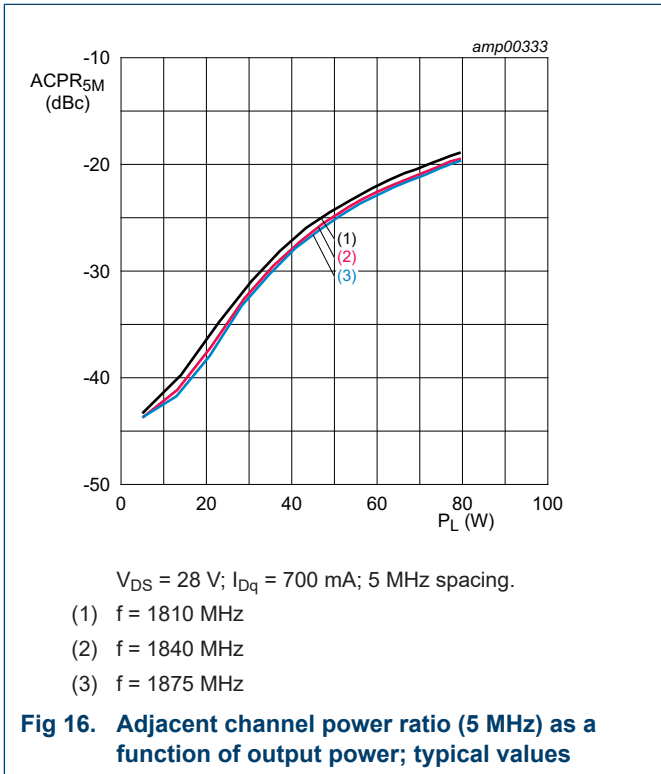
- (1)  $f = 1810\text{ MHz}$
- (2)  $f = 1840\text{ MHz}$
- (3)  $f = 1875\text{ MHz}$

**Fig 11. Drain efficiency as a function of output power; typical values**



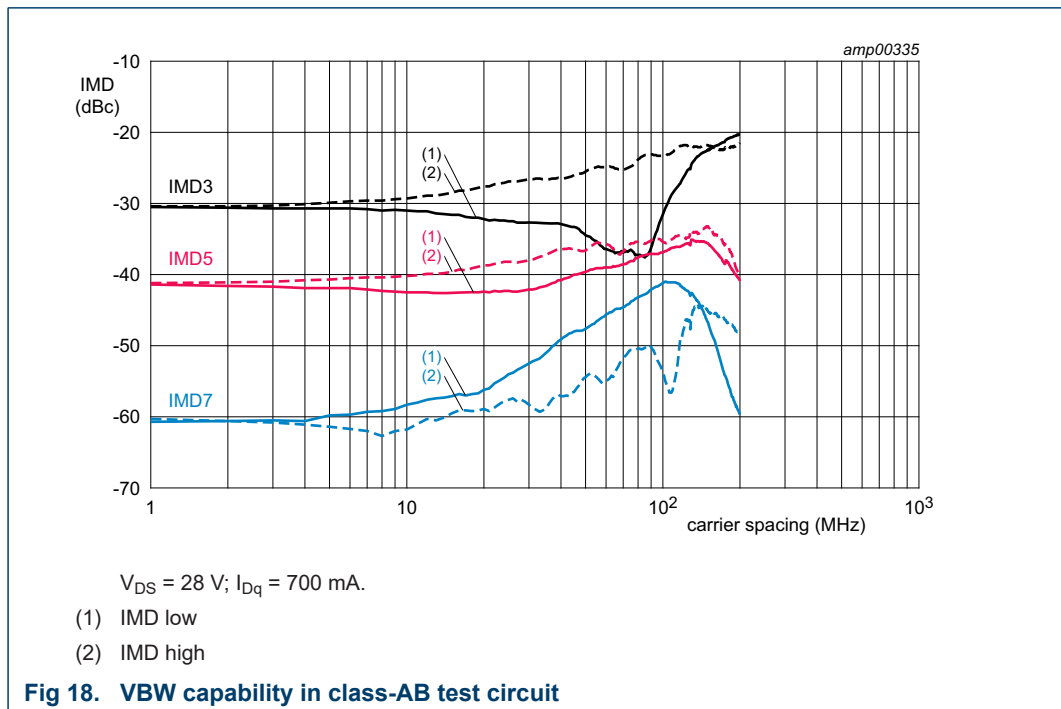
7.4.4 2-Carrier W-CDMA





7.4.5 2-Tone VBW

The BLC9G20LS-120VT shows 85 MHz (typical) video bandwidth (IMD third-order intermodulation inflection point) in a class-AB test circuit in the 1805 MHz to 1880 MHz band at  $V_{DS} = 28\text{ V}$  and  $I_{Dq} = 700\text{ mA}$ .



### 8. Package outline

Air cavity plastic earless flanged package; 6 leads

SOT1271-2

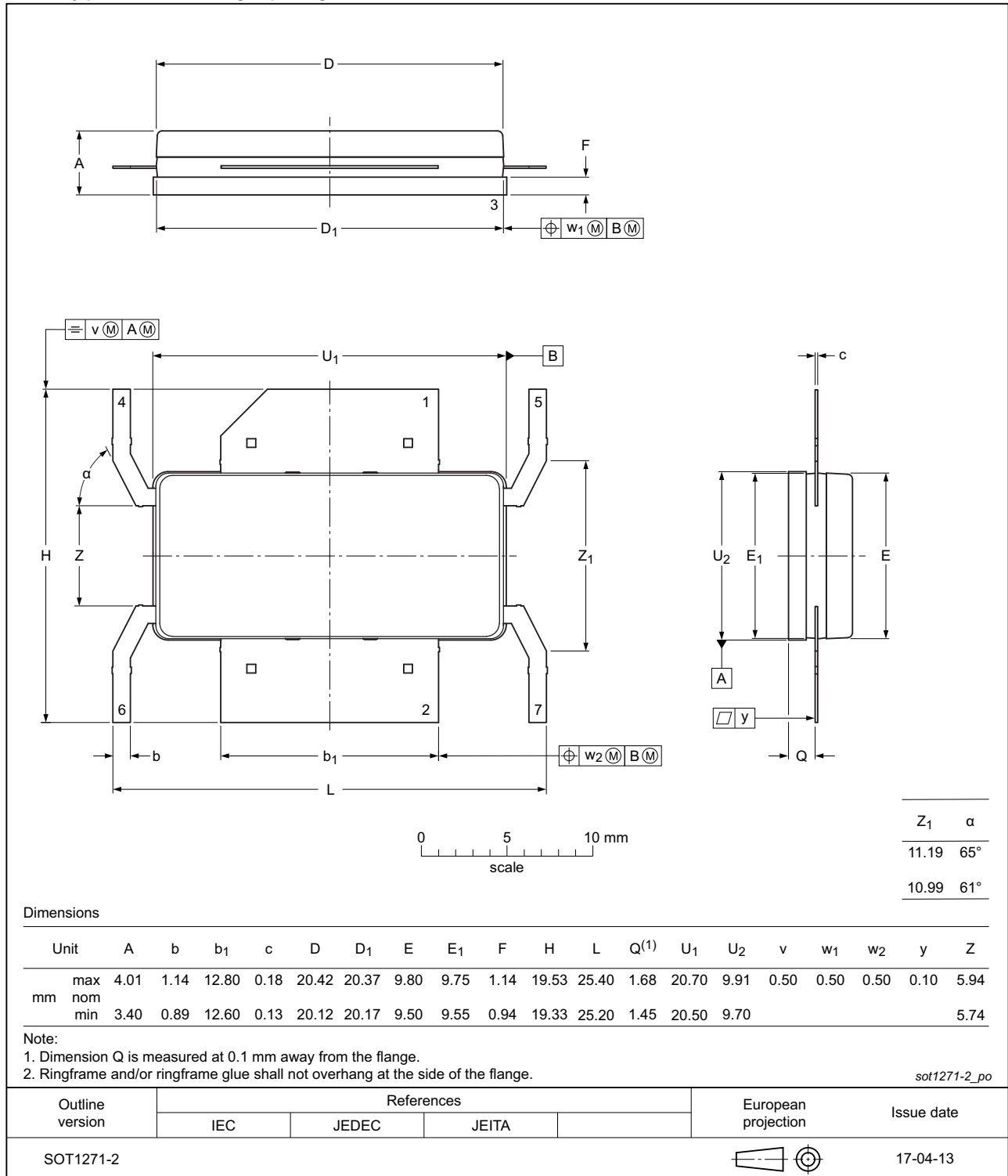


Fig 19. Package outline SOT1271-2

## 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.

**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	2 [2]

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

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

## 10. Abbreviations

**Table 12. Abbreviations**

Acronym	Description
3GPP	3rd Generation Partnership Project
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
DPCH	Dedicated Physical CHannel
ESD	ElectroStatic Discharge
IS-95	Interim Standard 95
LDMOS	Laterally Diffused Metal Oxide Semiconductor
MTF	Median Time to Failure
PAR	Peak-to-Average Ratio
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

## 11. Revision history

**Table 13. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLC9G20LS-120VT v.2	20180705	Product data sheet	-	LC9G20LS-120VT v.1
Modifications	<ul style="list-style-type: none"> <li>Table 2 on page 2: table corrected</li> </ul>			
BLC9G20LS-120VT v.1	20170523	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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Date of release: 5 July 2018  
 Document identifier: BLC9G20LS-120VT