

# BLC9G20LS-240PV

Power LDMOS transistor

Rev. 3 — 2 December 2016

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

240 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  $T_{case} = 25\text{ °C}$  in a common source class-AB production test circuit.*

Test signal	f	I <sub>DQ</sub>	V <sub>DS</sub>	P <sub>L(AV)</sub>	G <sub>p</sub>	η <sub>D</sub>	ACPR <sub>5M</sub>
	(MHz)	(mA)	(V)	(W)	(dB)	(%)	(dBc)
2-carrier W-CDMA	1805 to 1880	1600	28	60	18.0	30	-30 [1]

[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 (70 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
- 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 1805 MHz to 1995 MHz frequency range

## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain1		<p>aaa-007731</p>
2	drain2		
3	gate1		
4	gate2		
5	video decoupling		
6	video decoupling		
7	source <a href="#">[1]</a>		

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLC9G20LS-240PV	-	air cavity plastic earless flanged package; 6 leads	SOT1275-3

## 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
$V_{GS}$	gate-source voltage		-6	+13	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature <a href="#">[1]</a>		-	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	$T_{case} = 80\text{ °C}; P_L = 60\text{ W}$	0.4	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	$V_{GS} = 0\text{ V}; I_D = 0.6\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 20\text{ V}; I_D = 150\text{ mA}$	1.5	1.9	-	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 800\text{ mA}$	1.6	2.1	2.6	V
$I_{DSS}$	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 32\text{ V}$	-	-	1.4	$\mu\text{A}$
$I_{DSX}$	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 20\text{ V}$	-	25.4	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$	-	-	140	nA
$g_{fs}$	forward transconductance	$V_{DS} = 20\text{ V}; I_D = 7.5\text{ A}$	-	10	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 5.3\text{ A}$	-	0.1	-	$\Omega$

**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  $V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}; T_{case} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified; in a water cooled class-AB test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_{L(AV)} = 60\text{ W}$	16.8	18.0	-	dB
$\eta_D$	drain efficiency	$P_{L(AV)} = 60\text{ W}$	27	30	-	%
$RL_{in}$	input return loss	$P_{L(AV)} = 60\text{ W}$	-	-15	-9	dB
$ACPR_{5M}$	adjacent channel power ratio (5 MHz)	$P_{L(AV)} = 60\text{ W}$	-	-30	-25	dBc

## 7. Test information

### 7.1 Ruggedness in class-AB operation

The BLC9G20LS-240PV is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions:  $V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}$ ; 2-carrier W-CDMA signal;  $P_L = 120\text{ W}$  average;  $f_c = 1805\text{ MHz}$ ; 5 MHz spacing; 46 % clipping.

## 7.2 Impedance information

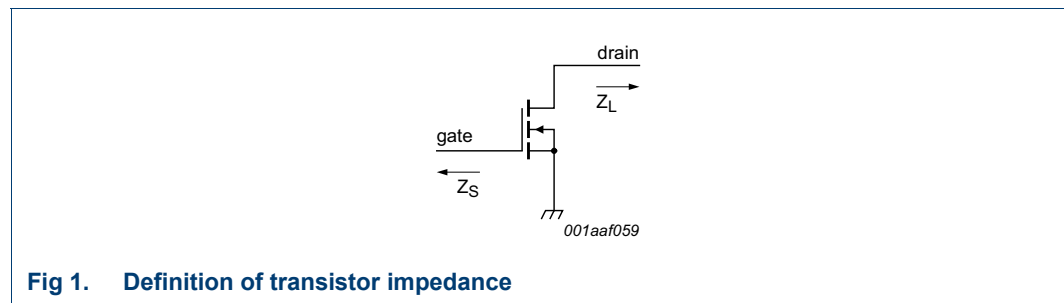
**Table 8. Typical impedance**

Measured load-pull data per section;  $I_{Dq} = 800 \text{ mA}$ ;  $V_{DS} = 28 \text{ V}$ ; pulsed CW ( $t_p = 100 \mu\text{s}$ ;  $\delta = 10 \%$ ).

f (MHz)	$Z_S$ [1] ( $\Omega$ )	$Z_L$ [1] ( $\Omega$ )	$P_L$ [2] (W)	$\eta_D$ [2] (%)	$G_p$ [2] (dB)
<b>Maximum power load</b>					
1805	2.2 – j7.3	2.4 – j8.0	201.0	60.4	15.4
1840	2.3 – j8.0	2.4 – j8.6	199.4	58.6	15.4
1880	2.8 – j8.3	2.2 – j8.7	200.6	59.5	15.6
1930	3.6 – j8.5	2.3 – j8.9	195.2	58.9	15.8
1960	5.0 – j8.7	2.2 – j9.0	192.7	57.8	16.0
1990	6.4 – j9.2	2.4 – j9.0	190.6	58.3	16.3
<b>Maximum drain efficiency load</b>					
1805	2.2 – j7.3	3.4 – j5.0	120.8	71.3	18.0
1840	2.3 – j8.0	3.1 – j6.0	134.7	69.8	17.8
1880	2.8 – j8.3	2.5 – j6.2	127.0	69.9	18.0
1930	3.6 – j8.5	2.4 – j6.6	127.6	68.3	18.3
1960	5.0 – j8.7	2.4 – j6.7	127.4	68.2	18.7
1990	6.4 – j9.2	2.2 – j6.9	133.5	67.4	18.7

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

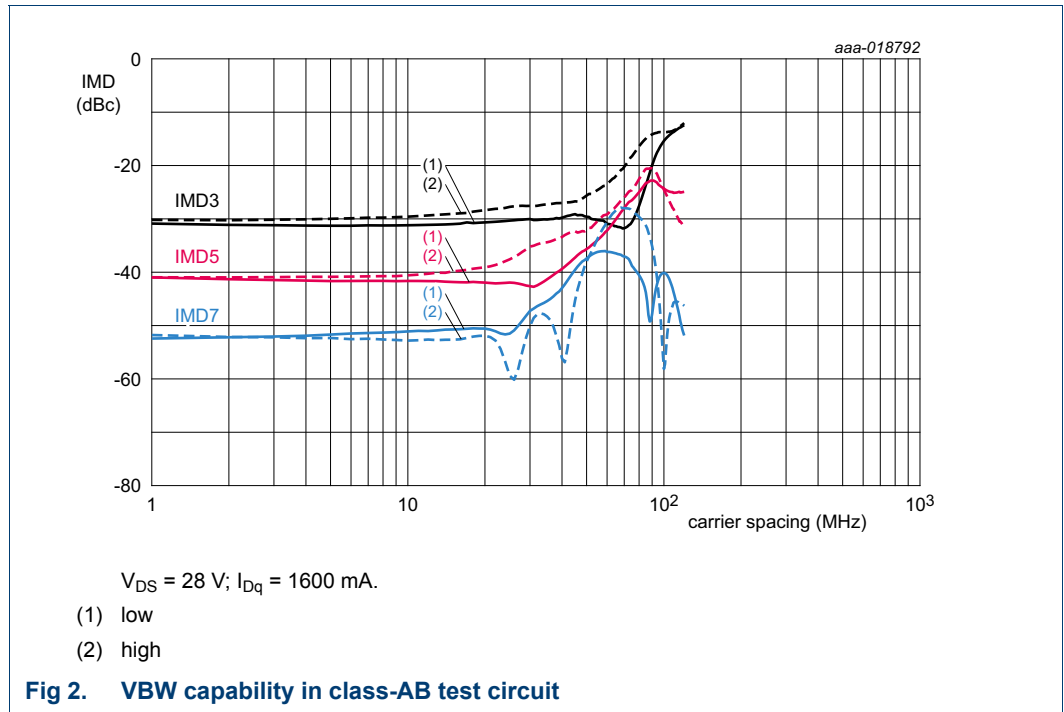
[2] at 3 dB gain compression.



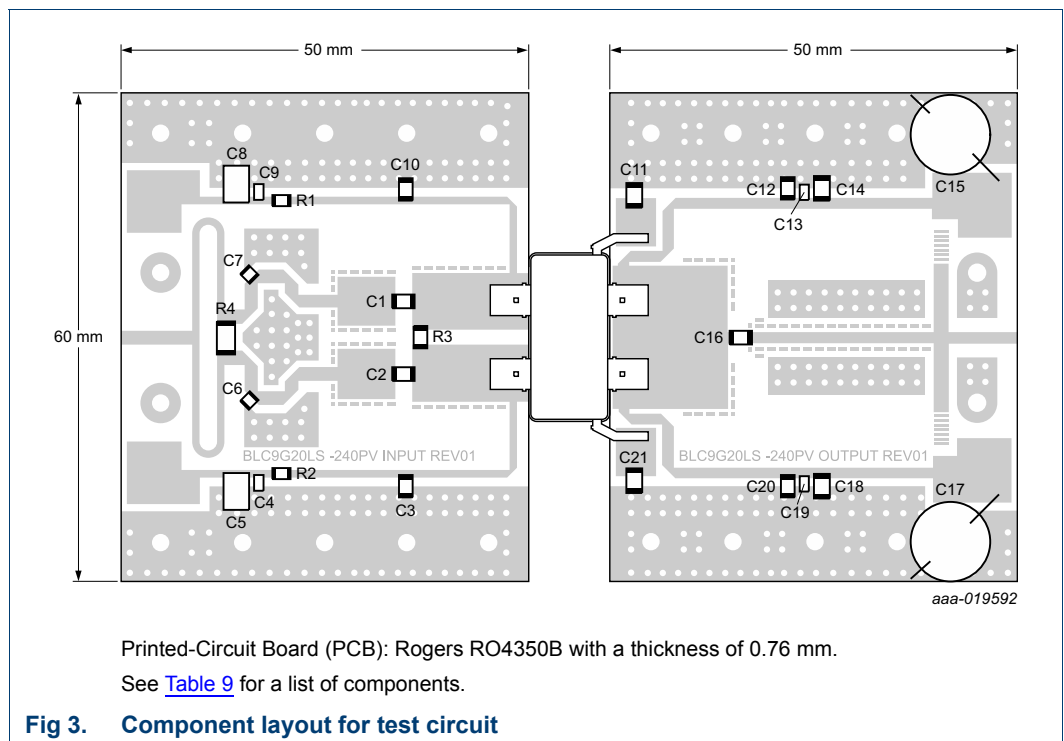
**Fig 1. Definition of transistor impedance**

## 7.3 VBW in a class-AB operation

The BLC9G20LS-240PV shows 70 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  $I_{Dq} = 1600 \text{ mA}$ .



7.4 Test circuit

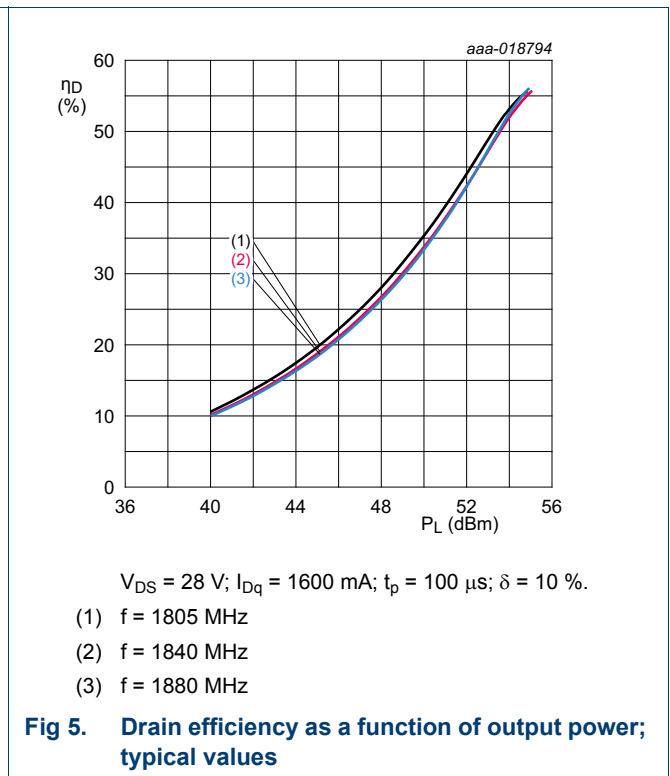
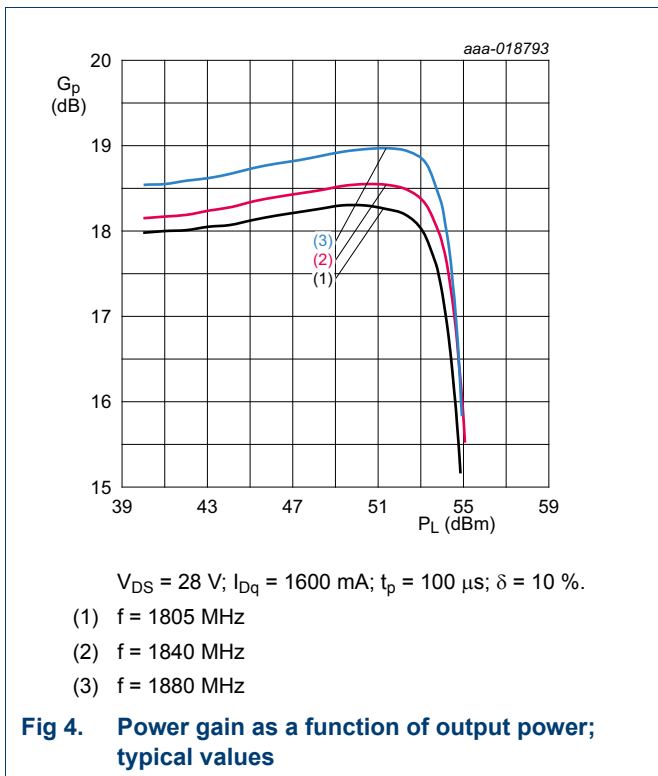


**Table 9. List of components**  
See [Figure 3](#) for component layout.

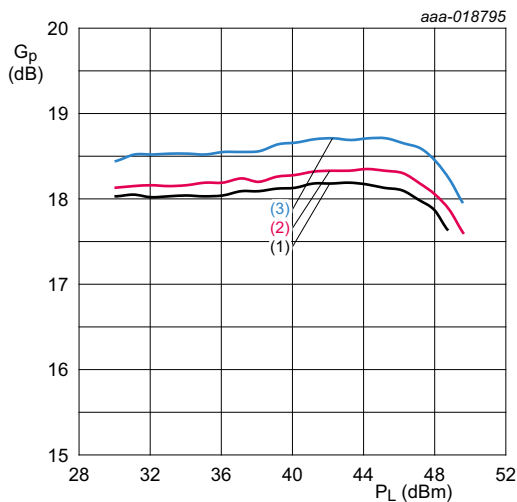
Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	0.5 pF	ATC 800B
C3, C10, C12, C20	multilayer ceramic chip capacitor	24 pF	ATC 800B
C4, C9	multilayer ceramic chip capacitor	100 nF	Murata
C5, C8	multilayer ceramic chip capacitor	1 μF	Murata
C6, C7	multilayer ceramic chip capacitor	3.3 pF	ATC 800A
C11, C14, C18, C21	multilayer ceramic chip capacitor	470 μF, 50 V	Murata
C13, C19	multilayer ceramic chip capacitor	220 nF	Murata
C15, C17	electrolytic capacitor	> 470 μF, 63 V	low ESR
C16	multilayer ceramic chip capacitor	1.2 pF	ATC 800B
R1, R2	resistor	4.7 Ω, 1 % tolerance	SMD 0805
R3	resistor	10 Ω, 1 % tolerance	SMD 0805
R4	resistor	100 Ω, 1 % tolerance	SMD 2010

## 7.5 Graphical data

### 7.5.1 Pulsed CW



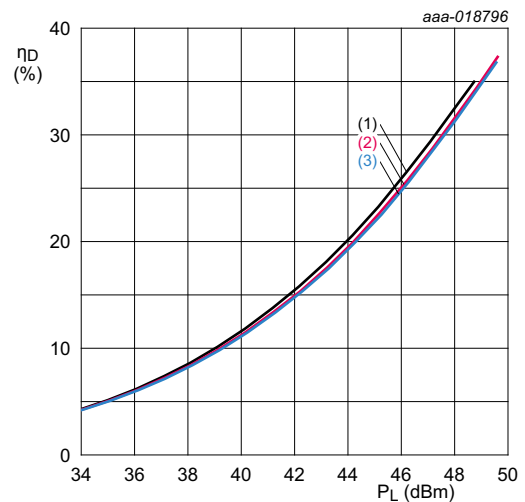
7.5.2 IS-95



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

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

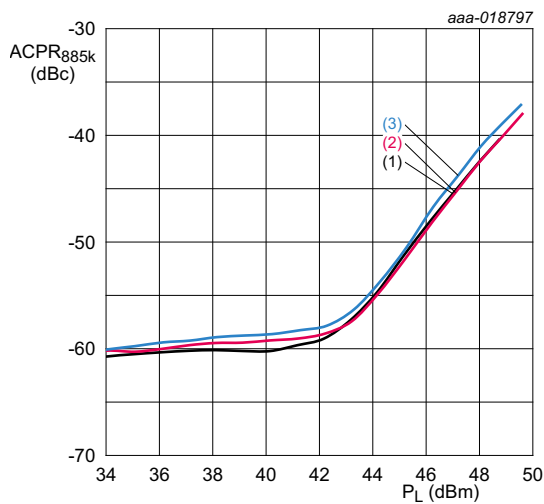
**Fig 6. Power gain as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

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

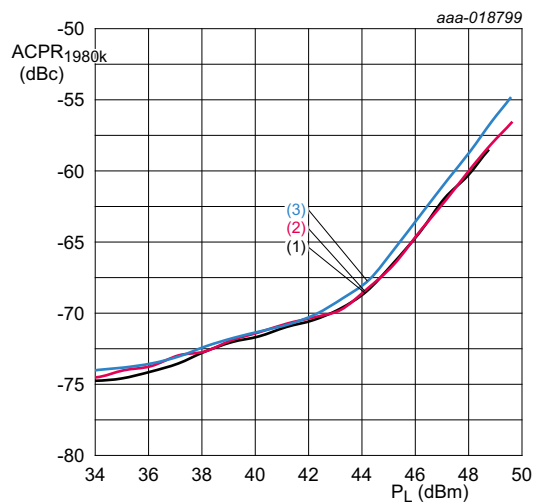
**Fig 7. Drain efficiency as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

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

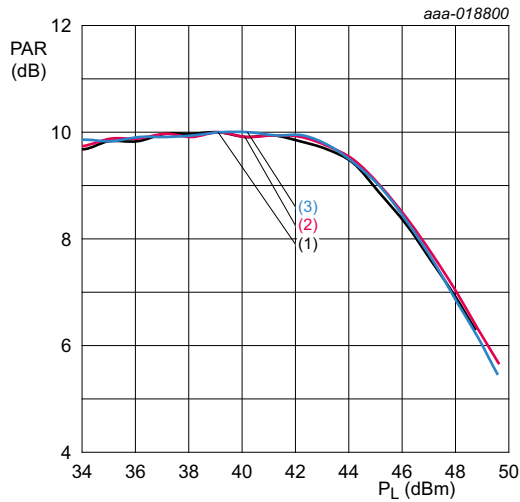
**Fig 8. Adjacent channel power ratio (885 kHz) as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

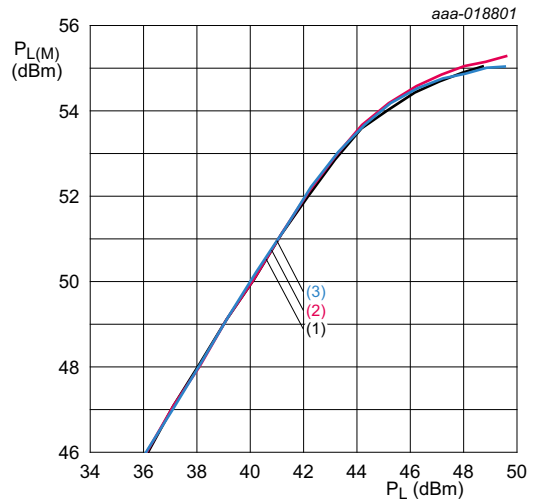
- (1)  $f = 1810\text{ MHz}$
- (2)  $f = 1840\text{ MHz}$
- (3)  $f = 1875\text{ MHz}$

**Fig 9. Adjacent channel power ratio (1980 kHz) as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

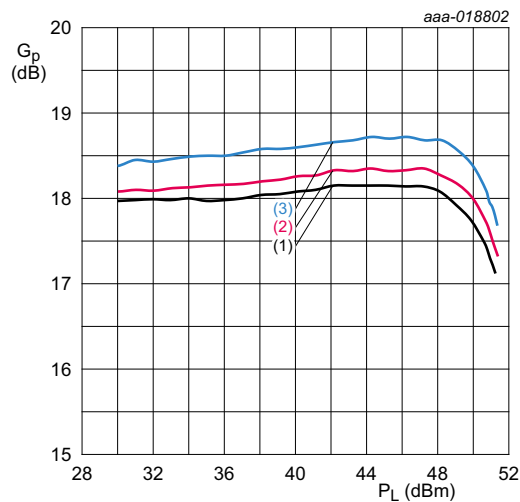
**Fig 10. Peak-to-average ratio as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

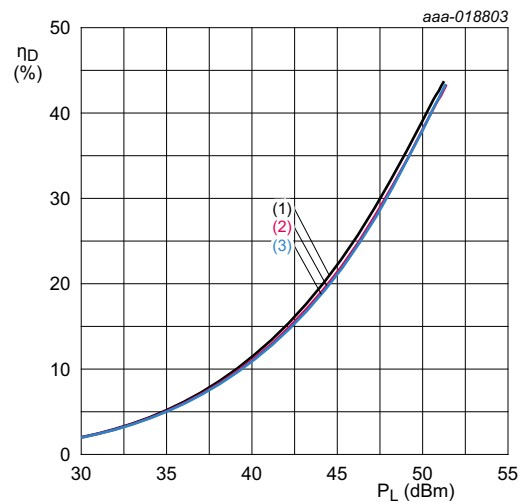
**Fig 11. Peak output power as a function of output power; typical values**

7.5.3 1-Carrier W-CDMA



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1807.5\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1877.5\text{ MHz}$

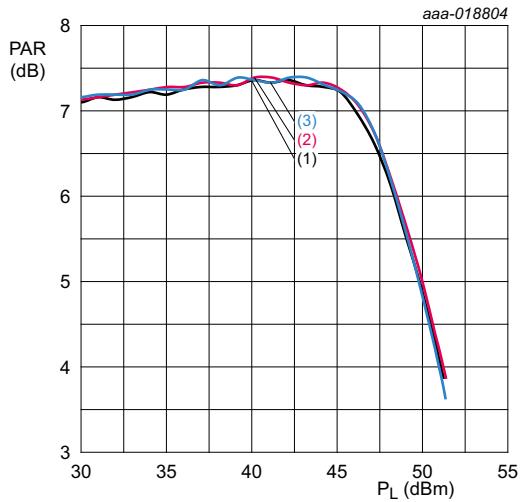
**Fig 12. Power gain as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1807.5\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1877.5\text{ MHz}$

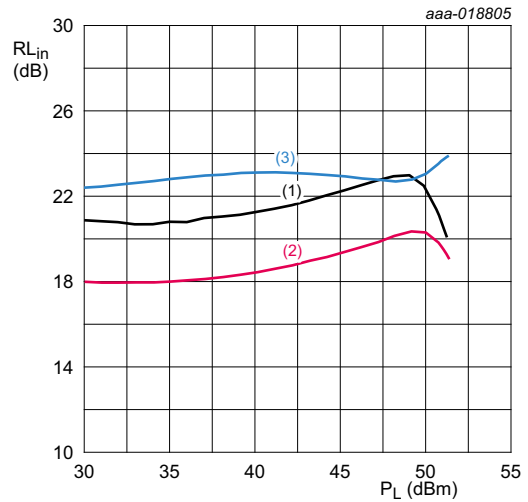
**Fig 13. Drain efficiency as a function of output power; typical values**





$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1807.5\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1877.5\text{ MHz}$

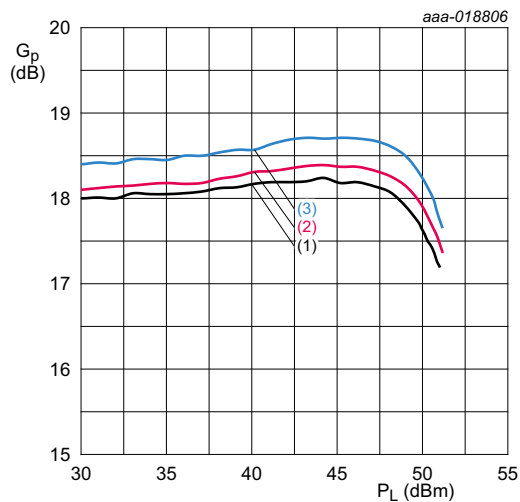
**Fig 14. Peak-to-average ratio as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1807.5\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1877.5\text{ MHz}$

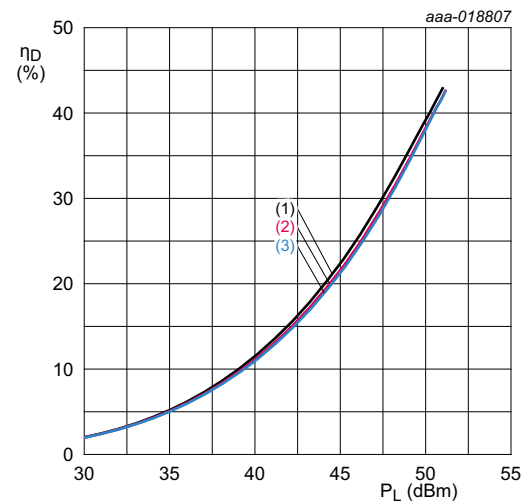
**Fig 15. Input return loss as a function of output power; typical values**

7.5.4 2-Carrier W-CDMA



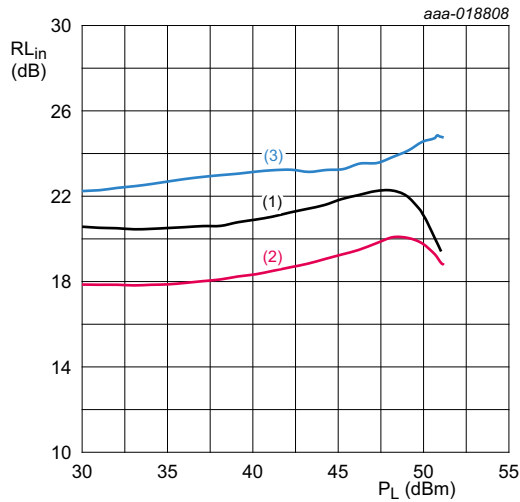
$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

**Fig 16. Power gain as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA}.$   
 (1)  $f = 1810\text{ MHz}$   
 (2)  $f = 1840\text{ MHz}$   
 (3)  $f = 1875\text{ MHz}$

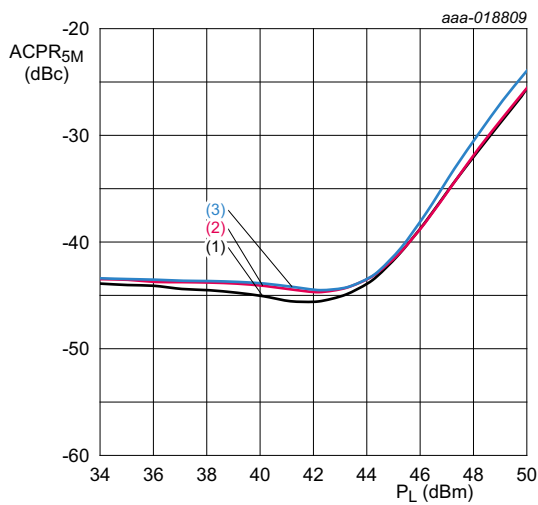
**Fig 17. Drain efficiency as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

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

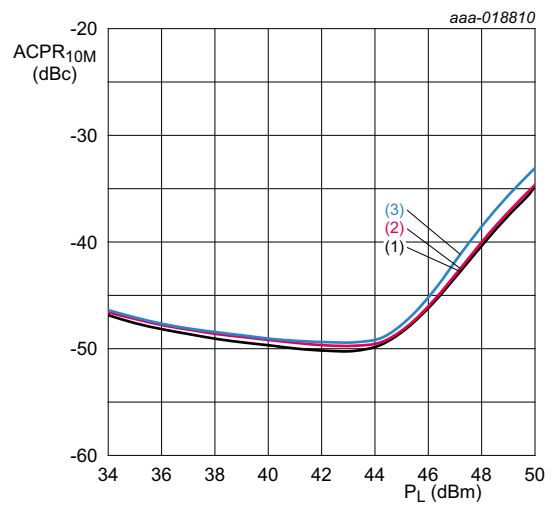
**Fig 18. Input return loss as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

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

**Fig 19. Adjacent channel power ratio (5 MHz) as a function of output power; typical values**



$V_{DS} = 28\text{ V}; I_{Dq} = 1600\text{ mA.}$

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

**Fig 20. Adjacent channel power ratio (10 MHz) as a function of output power; typical values**

8. Package outline

Air cavity plastic earless flanged package; 6 leads

SOT1275-3

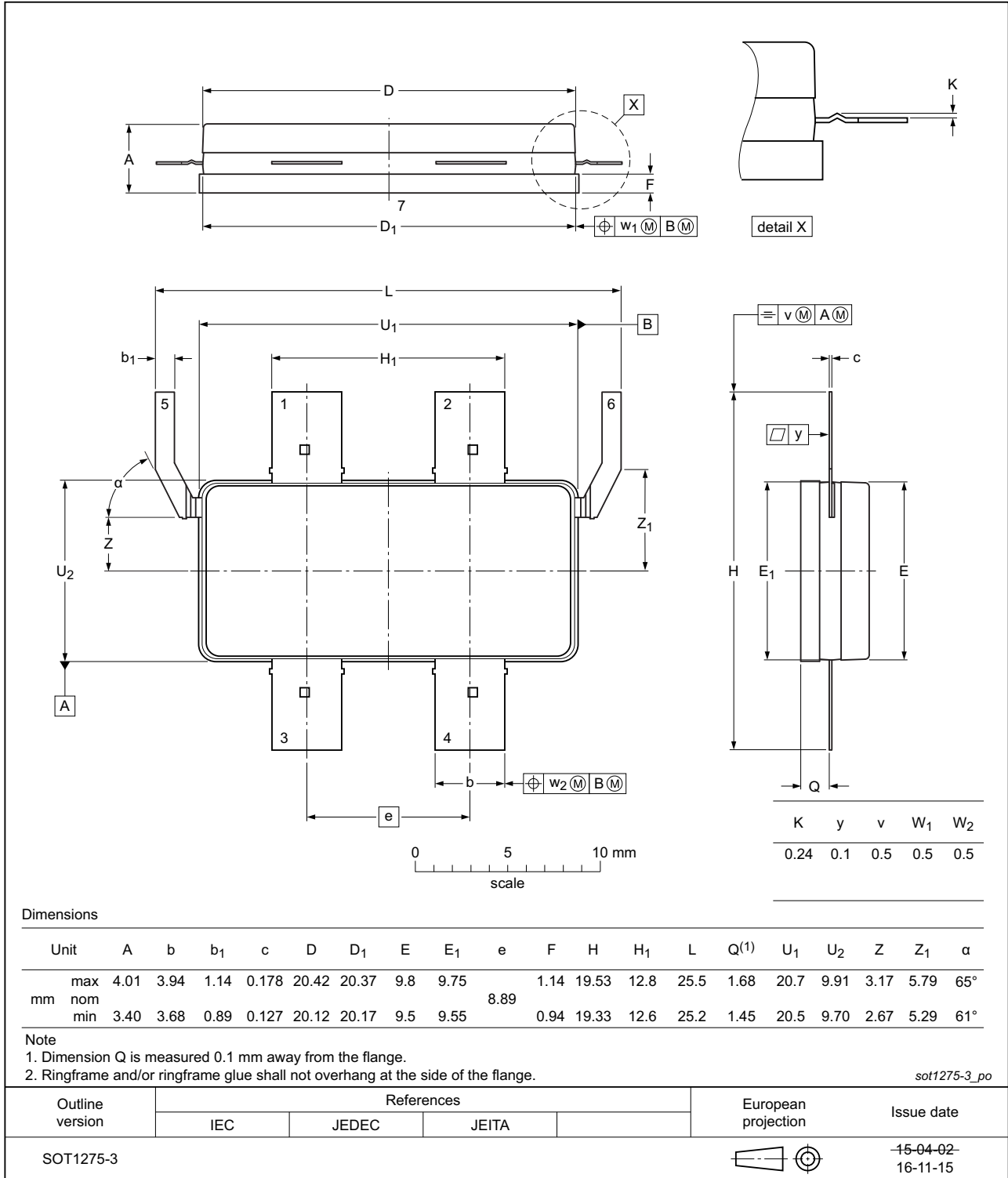


Fig 21. Package outline SOT1275-3

## 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.

**Table 10. ESD sensitivity**

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A <a href="#">[1]</a>
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2 <a href="#">[2]</a>

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V, but fails after exposure to an ESD pulse of 750 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V, but fails after exposure to an ESD pulse of 4000 V.

## 10. Abbreviations

**Table 11. Abbreviations**

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

## 11. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLC9G20LS-240PV v.3	20161202	Product data sheet	-	BLC9G20LS-240PV v.2
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">Figure 21 on page 11</a>: updated package outline drawing SOT1275-3</li><li>• <a href="#">Section 9 on page 12</a>: updated Handling information</li></ul>			
BLC9G20LS-240PV v.2	20160219	Product data sheet	-	BLC9G20LS-240PV v.1
BLC9G20LS-240PV v.1	20151005	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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