

# BLC10G22XS-301AVT

Power LDMOS transistor

Rev. 1 — 30 April 2020

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

300 W LDMOS packaged asymmetric Doherty power transistor for base station applications at frequencies from 2110 MHz to 2170 MHz.

**Table 1. Typical performance**

Typical RF performance at  $T_{case} = 25\text{ °C}$  in an asymmetrical Doherty demo circuit.  $V_{DS} = 30\text{ V}$ ;  $I_{DQ} = 300\text{ mA}$  (main);  $V_{GS(amp)peak} = 1.15\text{ V}$ , unless otherwise specified.

Test signal	f	$V_{DS}$	$P_{L(AV)}$	$G_p$	$\eta_D$	ACPR
	(MHz)	(V)	(dBm)	(dB)	(%)	(dBc)
1-carrier W-CDMA	2110 to 2170	30	47	16	47	-30 [1]

[1] Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability on CCDF.

### 1.2 Features and benefits

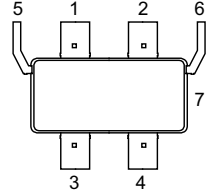
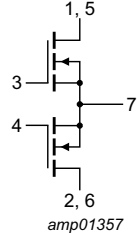
- Excellent ruggedness
- High efficiency
- Low thermal resistance providing excellent thermal stability
- Lower output capacitance for improved performance in Doherty applications
- Designed for low memory effects providing excellent digital pre-distortion capability
- Internally matched for ease of use
- Integrated ESD protection
- 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 2110 MHz to 2170 MHz frequency range

## 2. Pinning information

Table 2. Pinning

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

[1] Connected to flange.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLC10G22XS-301AVT	-	air cavity plastic earless flanged package; 6 leads	SOT1275-1

## 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		-6	+9	V
$V_{GS(amp)peak}$	peak amplifier gate-source voltage		-6	+9	V
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature	<sup>[1]</sup>	-	225	°C
$T_{case}$	case temperature	operating <sup>[1]</sup>	-40	+150	°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	$V_{DS} = 30 \text{ V}$ ; $I_{Dq} = 300 \text{ mA}$ (main); $V_{GS(amp)peak} = 1.15 \text{ V}$ ; $T_{case} = 80 \text{ °C}$		
		$P_L = 50 \text{ W}$	0.27	K/W
		$P_L = 80 \text{ W}$	0.22	K/W

## 6. Characteristics

**Table 6. DC characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Main device</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 0.9\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 90\text{ mA}$	1.6	2.0	2.4	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 540\text{ mA}$	-	2.2	-	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	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; V_{DS} = 10\text{ V}$	-	17	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 9\text{ V}; V_{DS} = 0\text{ V}$	-	-	140	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 3.15\text{ A}$	-	9	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; I_D = 3.15\text{ A}$	-	144	243	$\text{m}\Omega$
<b>Peak device</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 1.9\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 190\text{ mA}$	1.6	2.0	2.4	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 1140\text{ mA}$	-	2.2	-	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	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; V_{DS} = 10\text{ V}$	-	34	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 9\text{ V}; V_{DS} = 0\text{ V}$	-	-	140	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 6.65\text{ A}$	-	18.5	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; I_D = 6.65\text{ A}$	-	69	121	$\text{m}\Omega$

**Table 7. RF characteristics**

Test signal: 1-carrier W-CDMA; PAR = 7.2 dB at 0.01 % probability on the CCDF; 3GPP test model 1; 64 DPCH;  $f_1 = 2112.5\text{ MHz}$ ;  $f_2 = 2167.5\text{ MHz}$ ; RF performance at  $V_{DS} = 30\text{ V}$ ;  $I_{Dq} = 300\text{ mA}$  (main);  $V_{GS(amp)peak} = 1.1\text{ V}$ ;  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in an asymmetrical Doherty production test circuit at frequencies from 2110 MHz to 2170 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_{L(AV)} = 52\text{ W}$	13.8	15	-	dB
$RL_{in}$	input return loss	$P_{L(AV)} = 52\text{ W}$	-	-15	-9	dB
$\eta_D$	drain efficiency	$P_{L(AV)} = 52\text{ W}$	43	48	-	%
ACPR	adjacent channel power ratio	$P_{L(AV)} = 52\text{ W}$	-	-26	-21	dBc

**Table 8. RF characteristics**

Test signal: pulsed CW;  $t_p = 100\text{ }\mu\text{s}$ ;  $\delta = 10\text{ }\%$ ;  $f_1 = 2110\text{ MHz}$ ;  $f_2 = 2170\text{ MHz}$ ; RF performance at  $V_{DS} = 30\text{ V}$ ;  $I_{Dq} = 300\text{ mA}$ ;  $V_{GS(amp)peak} = 1.1\text{ V}$  (typical);  $T_{case} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified; in a Doherty production RF test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(3dB)}$	output power at 3 dB gain compression	-	280	350	-	W

## 7. Test information

### 7.1 Ruggedness in Doherty operation

The BLC10G22XS-301AVT is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 10 : 1$  through all phases under the following conditions:  $V_{DS} = 30$  V;  $I_{DQ} = 300$  mA;  $V_{GS(amp)peak} = 1.1$  V;  $f = 2110$  MHz;  $P_L = 180$  W; CW.

### 7.2 Impedance information

**Table 9. Typical impedance of main device**

Measured load-pull data of main device;  $I_{DQ} = 540$  mA (main);  $V_{DS} = 30$  V; pulsed CW ( $t_p = 100$   $\mu$ 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>					
2110	14.2 + j8.4	3.4 – j5.8	131	57.7	20.2
2140	7.8 + j8.6	3.4 – j5.8	125	57.6	20.3
2170	4.7 + j6.5	3.6 – j6.3	135	59.4	20.0
<b>Maximum drain efficiency load</b>					
2110	14.2 + j8.4	3.6 – j3.4	97	64.3	18.7
2140	7.8 + j8.6	3.9 – j3.7	97	63.6	18.9
2170	4.7 + j6.5	3.6 – j3.4	92	66.6	18.7

[1]  $Z_S$  and  $Z_L$  defined in [Figure 1](#).

[2] At 3 dB gain compression.

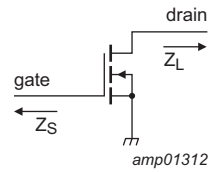
**Table 10. Typical impedance of peak device**

Measured load-pull data of peak device;  $I_{DQ} = 1100$  mA (peak);  $V_{DS} = 30$  V; pulsed CW ( $t_p = 100$   $\mu$ 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>					
2110	4.0 – j11.0	4.2 – j6.1	265	62.7	17.1
2140	4.7 – j11.0	4.4 – j6.7	268	61.9	17.1
2170	5.9 – j12.0	4.6 – j7.4	262	59.4	17.1
<b>Maximum drain efficiency load</b>					
2110	4.0 – j11.0	5.4 – j4.5	218	66.3	14.9
2140	4.7 – j11.0	5.0 – j4.1	204	66.4	15.1
2170	5.9 – j12.0	5.0 – j5.0	217	65.0	15.1

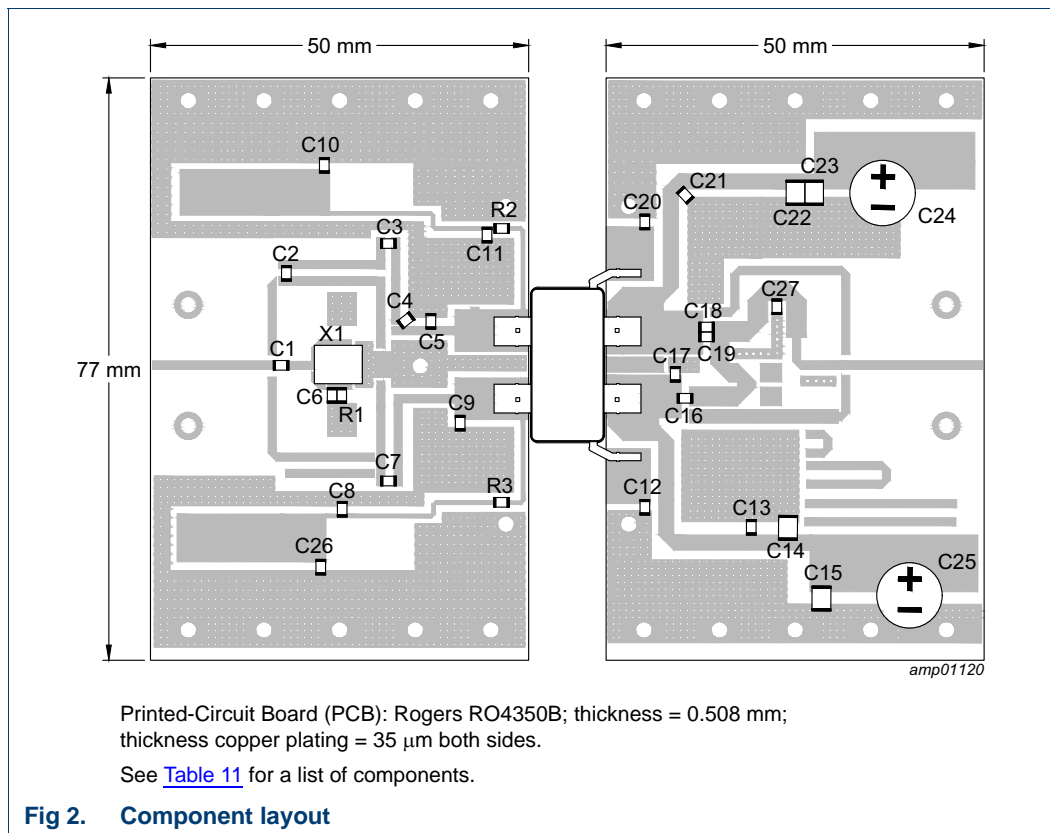
[1]  $Z_S$  and  $Z_L$  defined in [Figure 1](#).

[2] At 3 dB gain compression.



**Fig 1. Definition of transistor impedance**

### 7.3 Test circuit



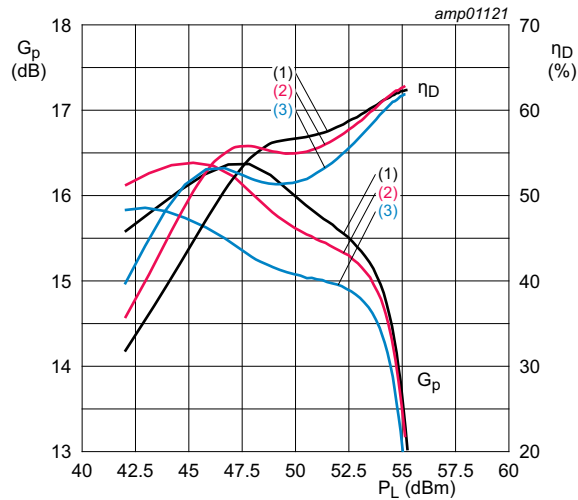
**Table 11. List of components**

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

Component	Description	Value	Remarks
C1, C2, C3, C7, C8, C11, C13, C21	multilayer ceramic chip capacitor	10 pF	ATC: SMD 0805
C4, C17	multilayer ceramic chip capacitor	1 pF	ATC: SMD 0805
C5	multilayer ceramic chip capacitor	1.3 pF	ATC: SMD 0805
C6	multilayer ceramic chip capacitor	0.6 pF	ATC: SMD 0805
C9	multilayer ceramic chip capacitor	0.5 pF	ATC: SMD 0805
C10, C14, C15, C22, C23	multilayer ceramic chip capacitor	10 $\mu\text{F}$ , 100 V	Murata: SMD 1210
C12, C20	multilayer ceramic chip capacitor	10 $\mu\text{F}$ , 50 V	Murata: SMD 1210
C16	multilayer ceramic chip capacitor	11 pF	ATC 800B
C18, C19	multilayer ceramic chip capacitor	1.2 pF	ATC 800B
C24, C25	electrolytic capacitor	1000 $\mu\text{F}$ , 100 V	
C27	multilayer ceramic chip capacitor	0.4 pF	ATC: SMD 0805
R1	resistor	50 $\Omega$ , 25 W	Anaren: C16A50Z4
R2, R3	resistor	5.6 $\Omega$ , 1 %	SMD 0805
X1	hybrid coupler	5 dB	X3C21P1-05S

## 7.4 Graphical data

### 7.4.1 Pulsed CW



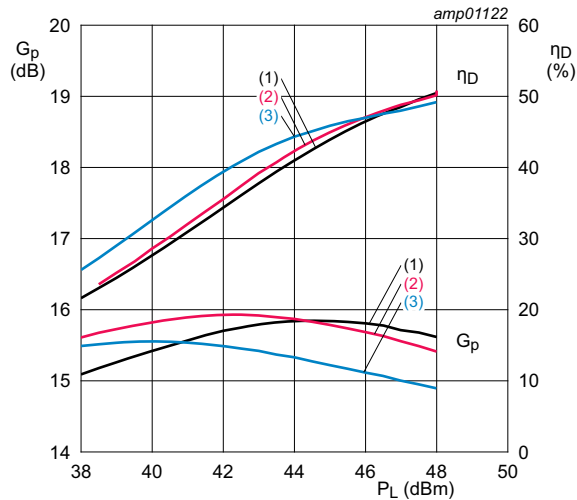
$V_{DS} = 30 \text{ V}$ ;  $I_{DQ} = 300 \text{ mA}$ ;  $V_{GS(amp)peak} = 1.1 \text{ V}$ ;  $t_p = 100 \text{ } \mu\text{s}$ ;  $\delta = 10 \text{ } \%$ .

- (1)  $f = 2110 \text{ MHz}$
- (2)  $f = 2140 \text{ MHz}$
- (3)  $f = 2170 \text{ MHz}$

**Fig 3. Power gain and drain efficiency as function of output power; typical values**

### 7.4.2 1-Carrier W-CDMA

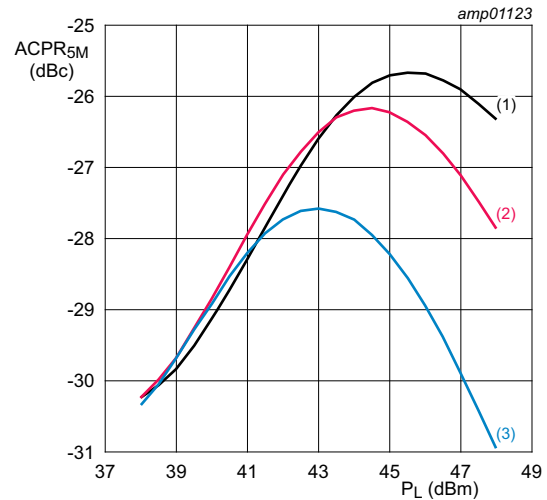
Test signal: 1-carrier W-CDMA; 3GPP test model 1; 64 DPCH; PAR = 7.2 dB at 0.01 % probability on CCDF.



$V_{DS} = 30 \text{ V}$ ;  $I_{DQ} = 300 \text{ mA}$ ;  $V_{GS(amp)peak} = 1.1 \text{ V}$ .

- (1)  $f = 2112.5 \text{ MHz}$
- (2)  $f = 2140 \text{ MHz}$
- (3)  $f = 2167.5 \text{ MHz}$

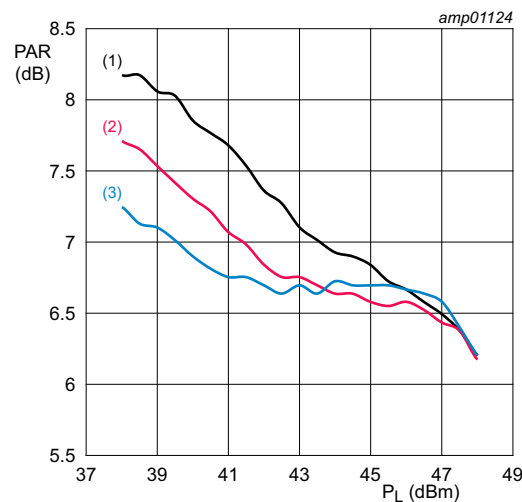
**Fig 4. Power gain and drain efficiency as function of output power; typical values**



$V_{DS} = 30 \text{ V}$ ;  $I_{DQ} = 300 \text{ mA}$ ;  $V_{GS(amp)peak} = 1.1 \text{ V}$ .

- (1)  $f = 2112.5 \text{ MHz}$
- (2)  $f = 2140 \text{ MHz}$
- (3)  $f = 2167.5 \text{ MHz}$

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



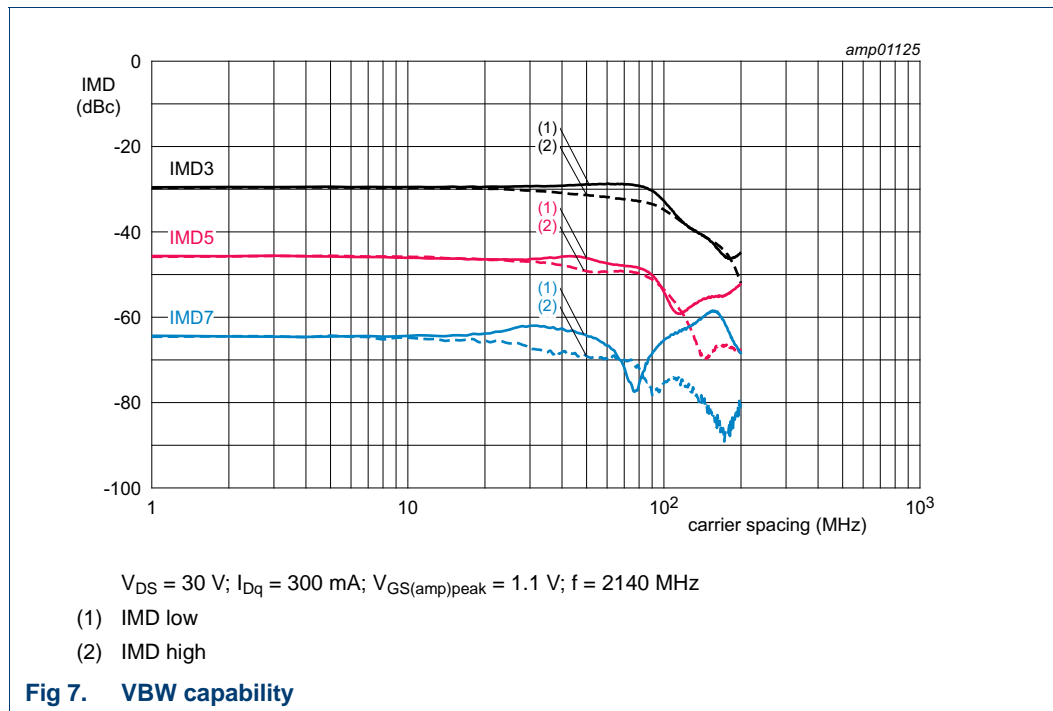
$V_{DS} = 30 \text{ V}$ ;  $I_{DQ} = 300 \text{ mA}$ ;  $V_{GS(amp)peak} = 1.1 \text{ V}$ .

- (1)  $f = 2112.5 \text{ MHz}$
- (2)  $f = 2140 \text{ MHz}$
- (3)  $f = 2167.5 \text{ MHz}$

**Fig 6. Peak-to-average power ratio as a function of output power; typical values**



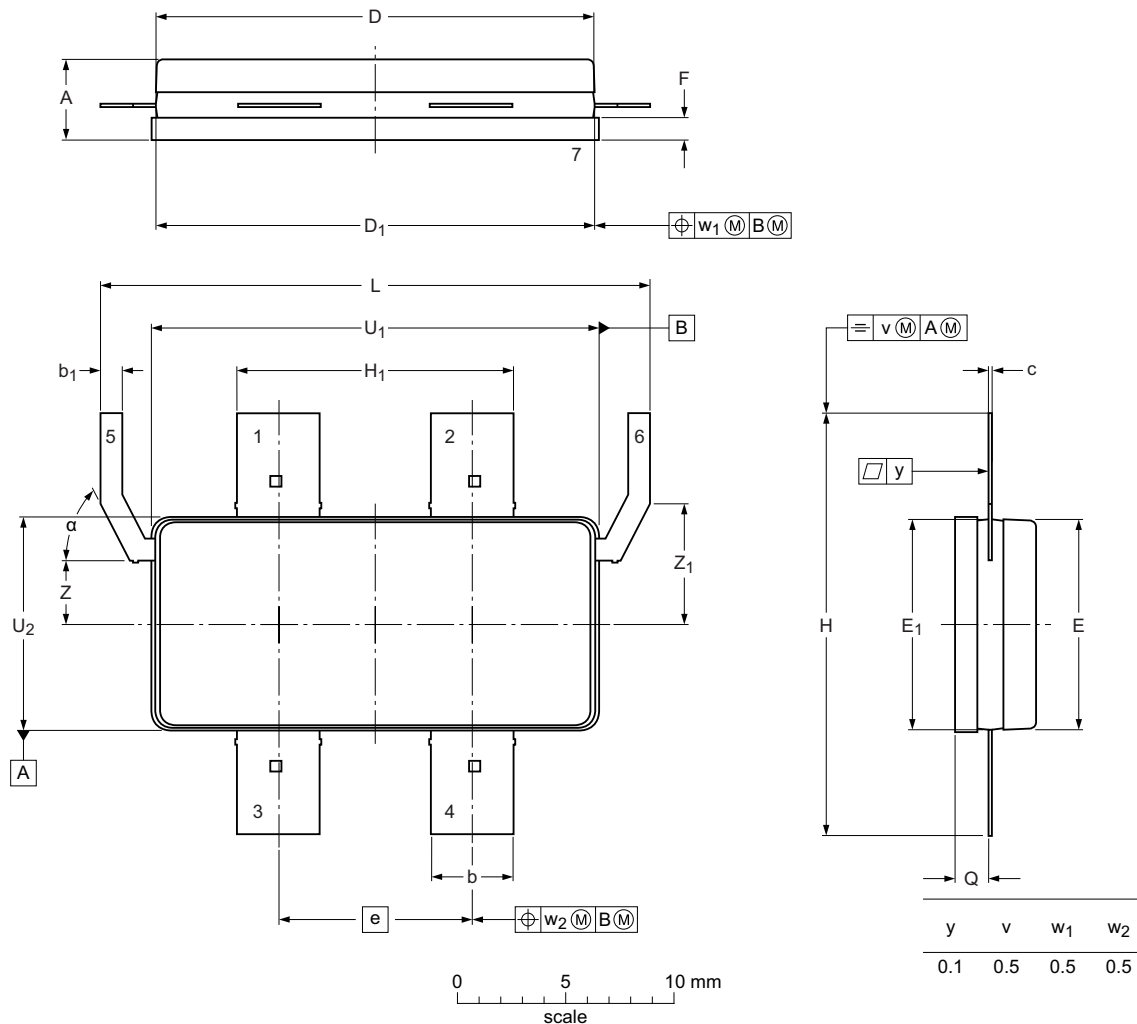
### 7.4.3 2-Tone VBW



## 8. Package outline

Air cavity plastic earless flanged package; 6 leads

SOT1275-1



Dimensions

Unit	A	b	b <sub>1</sub>	c	D	D <sub>1</sub>	E	E <sub>1</sub>	e	F	H	H <sub>1</sub>	L	Q <sup>(1)</sup>	U <sub>1</sub>	U <sub>2</sub>	Z	Z <sub>1</sub>	α
max	4.01	3.94	1.14	0.178	20.42	20.37	9.80	9.75		1.14	19.53	12.80	25.40	1.68	20.70	9.91	3.17	5.79	65°
nom									8.89										
min	3.40	3.68	0.89	0.127	20.12	20.17	9.50	9.55		0.94	19.33	12.60	25.20	1.45	20.50	9.70	2.67	5.29	61°

Note

1. Dimension Q is measured 0.1 mm away from the flange.
2. Ringframe and/or ringframe glue shall not overhang at the side of the flange.

sot1275-1\_po

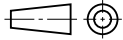
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1275-1						16-11-15 17-04-13

Fig 8. Package outline SOT1275-1

## 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 12. 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.

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

## 10. Abbreviations

**Table 13. Abbreviations**

Acronym	Description
3GPP	3rd Generation Partnership Project
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
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 14. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLC10G22XS-301AVT v.1	20200430	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".

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For sales office addresses, please visit: <http://www.ampleon.com/sales>

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Date of release: 30 April 2020

Document identifier: BLC10G22XS-301AVT