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# BLC10G27LS-320AVT

Power LDMOS transistor

Rev. 2 — 1 December 2017

AMPLEON

Product data sheet

## 1. Product profile

### 1.1 General description

320 W LDMOS packaged asymmetrical Doherty power transistor for base station applications at frequencies from 2500 MHz to 2700 MHz.

**Table 1. Typical performance**

Typical RF performance at  $T_{case} = 25\text{ °C}$  in the Doherty demo board.

Test signal	f	V <sub>DS</sub>	P <sub>L(AV)</sub>	G <sub>p</sub>	η <sub>D</sub>	ACPR
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)
1-carrier W-CDMA	2500 to 2700	28	50	16	45	-30 [1]

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

### 1.2 Features and benefits

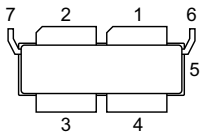
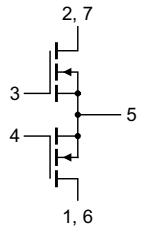
- Excellent ruggedness
- High efficiency
- Low thermal resistance providing excellent thermal stability
- Decoupling leads to enable improved video bandwidth
- Lower output capacitance for improved performance in Doherty applications
- Designed for low memory effects providing excellent pre-distortability
- 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 amplifier for W-CDMA base stations and multi carrier applications in the 2500 MHz to 2700 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 <a href="#">[1]</a>		
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
BLC10G27LS-320AVT	-	air cavity plastic earless flanged package; 6 leads	SOT1258-1

## 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
$V_{GS}$	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
$R_{th(j-case)}$	thermal resistance from junction to case	$T_{case} = 80\text{ °C}; P_L = 80\text{ W}$	0.24	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	$V_{GS} = 0\text{ V}; I_D = 1\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 100\text{ mA}$	1.5	2	2.5	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 400\text{ mA}$	1.7	2.2	2.7	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	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; V_{DS} = 10\text{ V}$	-	20	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$	-	-	280	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 5.0\text{ A}$	-	12	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; I_D = 3.5\text{ A}$	-	125	170	$\text{m}\Omega$
<b>Peak device</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 2.08\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 208\text{ mA}$	1.5	2	2.5	V
$V_{GSq}$	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_D = 1000\text{ mA}$	1.7	2.2	2.7	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	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; V_{DS} = 10\text{ V}$	-	39	-	A
$I_{GSS}$	gate leakage current	$V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$	-	-	280	nA
$g_{fs}$	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 10.4\text{ A}$	-	23	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 2.37\text{ V}; I_D = 7.28\text{ A}$	-	63.0	96.6	$\text{m}\Omega$

**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; 1 to 64 DPCH; RF performance at  $V_{DS} = 28\text{ V}; I_{Dq} = 400\text{ mA}$  (main);  $V_{GS(amp)peak} = 1\text{ V}; T_{case} = 25\text{ }^\circ\text{C}$ ; unless otherwise specified; in an asymmetrical Doherty production test circuit at frequencies from 2496 MHz to 2690 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$G_p$	power gain	$P_{L(AV)} = 50\text{ W}$	14.6	15.4	-	dB
$RL_{in}$	input return loss	$P_{L(AV)} = 50\text{ W}$	-	-10	-6	dB
$\eta_D$	drain efficiency	$P_{L(AV)} = 50\text{ W}$	37.6	42	-	%
ACPR	adjacent channel power ratio	$P_{L(AV)} = 50\text{ W}$	-	-32	-27	dBc

## 7. Test information

### 7.1 Ruggedness in Doherty operation

The BLC10G27LS-320AVT is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions:  $V_{DS} = 28\text{ V}; I_{Dq} = 400\text{ mA}$  (main);  $V_{GS(amp)peak} = 1\text{ V}; P_L = 200\text{ W}$  (CW);  $f = 2496\text{ MHz}$ .

## 7.2 Impedance information

**Table 8. Typical impedance of main device**

Measured load-pull data of main device;  $I_{Dq} = 600 \text{ mA}$ ;  $V_{DS} = 28 \text{ V}$ . Typical values unless otherwise specified.

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>					
2500	1.8 – j5.6	2.1 – j4.1	140	61.0	17.1
2600	2.9 – j6.2	2.0 – j3.8	140	61.5	17.0
2700	5.4 – j6.0	1.8 – j4.2	140	57.0	16.6
<b>Maximum drain efficiency load</b>					
2500	1.8 – j5.6	3.1 – j3.0	111	65.2	18.6
2600	2.9 – j6.2	3.1 – j3.0	107	65.8	18.7
2700	5.4 – j6.0	2.4 – j3.2	119	63.7	18.1

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

[2] at 3 dB gain compression.

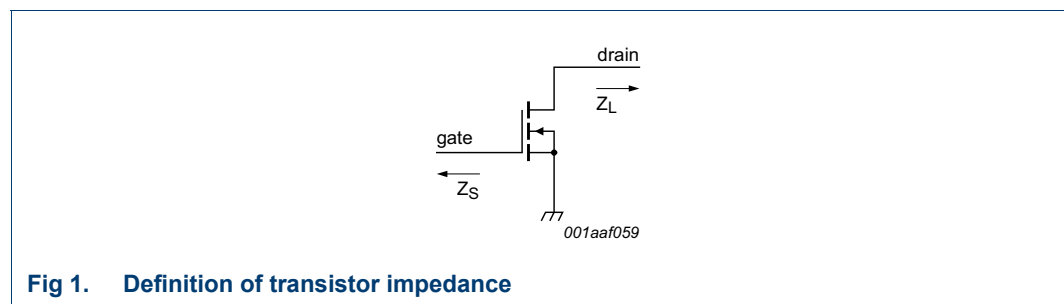
**Table 9. Typical impedance of peak device**

Measured load-pull data of peak device;  $I_{Dq} = 1200 \text{ mA}$ ;  $V_{DS} = 28 \text{ V}$ . Typical values unless otherwise specified.

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>					
2500	2.2 – j6.4	2.4 – j3.9	270	59.1	16.5
2600	4.6 – j7.3	2.4 – j3.9	266	56.9	15.9
2700	10.7 – j5.0	2.4 – j3.9	254	55.6	16.5
<b>Maximum drain efficiency load</b>					
2500	2.2 – j6.4	3.4 – j2.7	221	64.4	17.9
2600	4.6 – j7.3	2.8 – j2.7	227	62.0	17.1
2700	10.7 – j5.0	2.6 – j2.5	207	60.8	17.8

[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 Doherty operation

The BLC10G27LS-320AVT shows 120 MHz (typical) video bandwidth in Doherty test circuit in 2600 MHz band at  $V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 400\text{ mA}$  (main);  $V_{GS(amp)peak} = 1\text{ V}$ ;

7.4 Test circuit

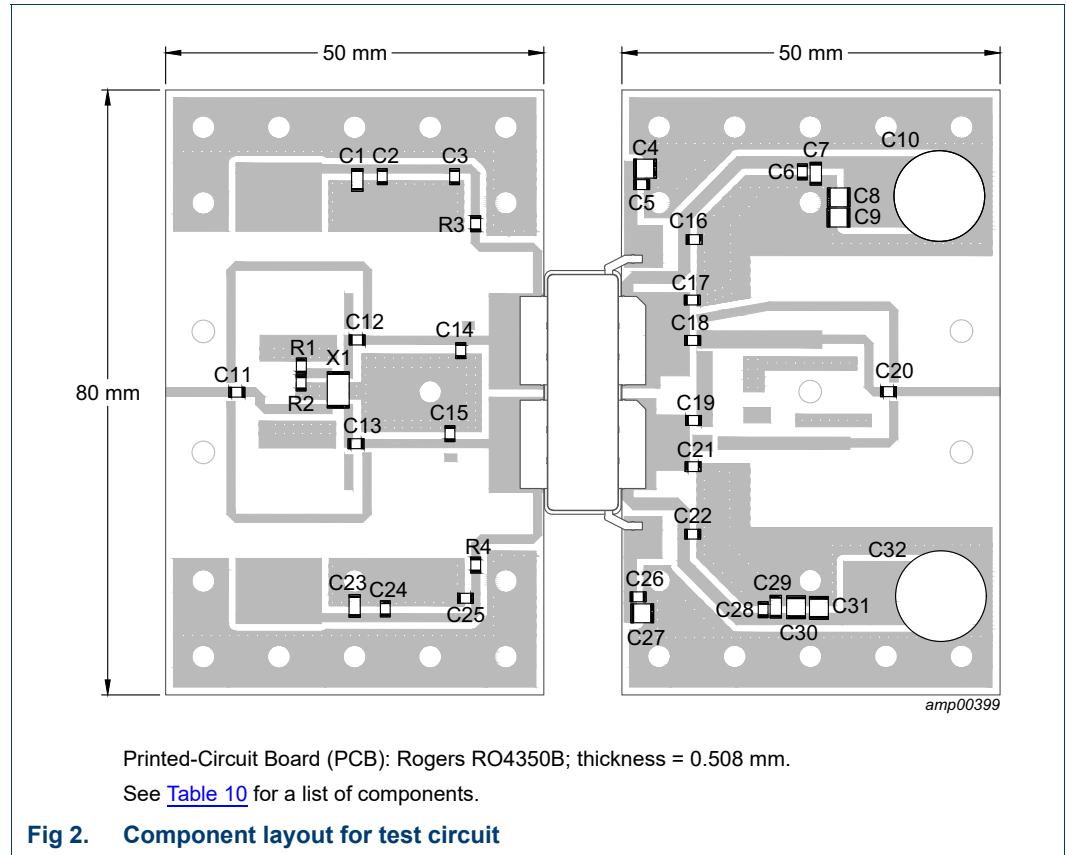


Table 10. List of components

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

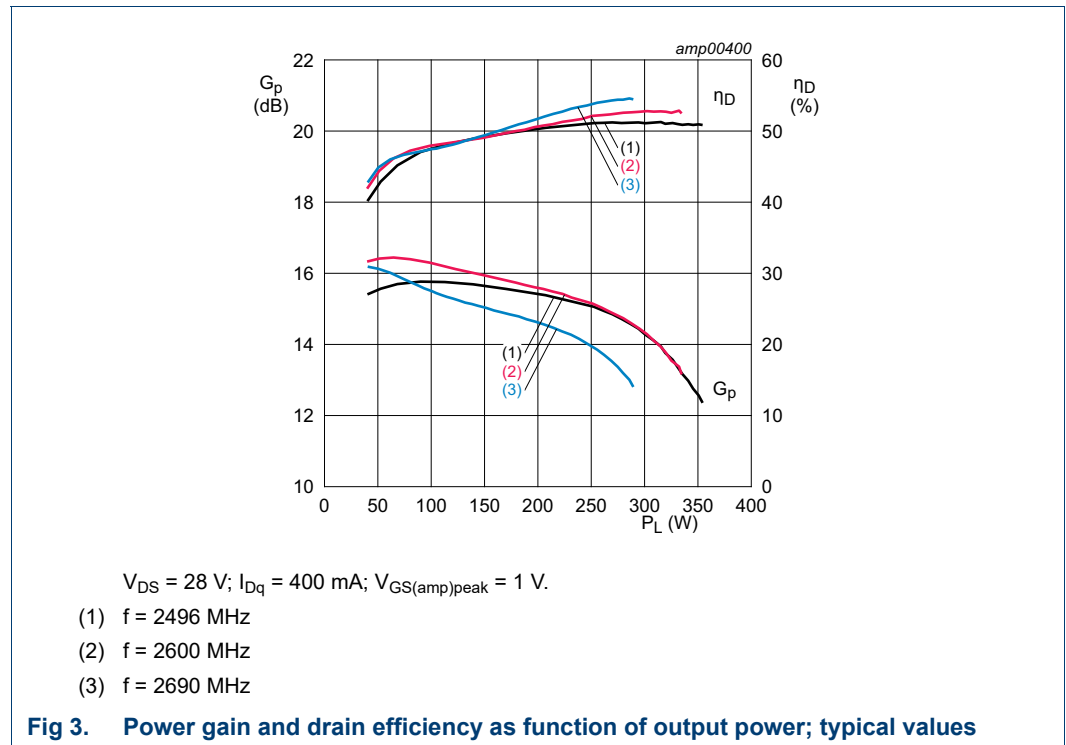
Component	Description	Value	Remarks
C1, C7, C23, C29	multilayer ceramic chip capacitor	1 $\mu\text{F}$	Murata
C2, C3, C5, C6, C11, C12, C13, C16, C18, C19, C20, C22, C24, C25, C26, C28	multilayer ceramic chip capacitor	20 pF	ATC 600F
C4, C8, C9, C27, C30, C31	multilayer ceramic chip capacitor	4.7 $\mu\text{F}$	Murata
C10, C32	electrolytic capacitor	2200 $\mu\text{F}$ , 63 V	
C14, C15	multilayer ceramic chip capacitor	0.7 pF	ATC 600F
C17	multilayer ceramic chip capacitor	0.2 pF	ATC 600F
C21	multilayer ceramic chip capacitor	1.3 pF	ATC 600F

Table 10. List of components ...continued  
See Figure 2 for component layout.

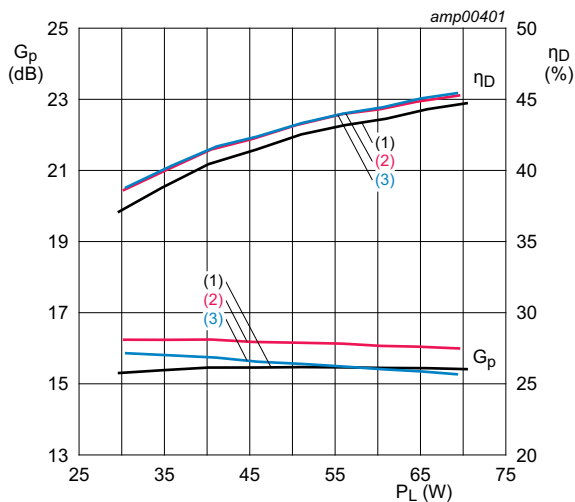
Component	Description	Value	Remarks
R1, R2	resistor	100 Ω	SMD 1206
R3, R4	resistor	5.1 Ω	SMD 0805
X1	coupler		Anaren: X3C25F1-02S

## 7.5 Graphical data

### 7.5.1 Pulsed CW



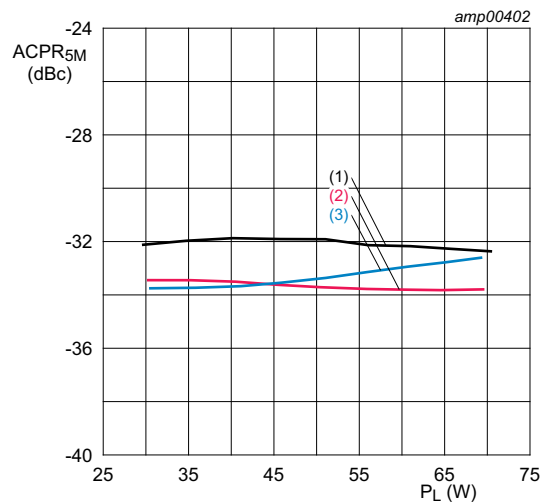
7.5.2 1-Carrier W-CDMA



$V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 400\text{ mA}$ ;  $V_{GS(amp)peak} = 1\text{ V}$ .

- (1)  $f = 2496\text{ MHz}$
- (2)  $f = 2600\text{ MHz}$
- (3)  $f = 2690\text{ MHz}$

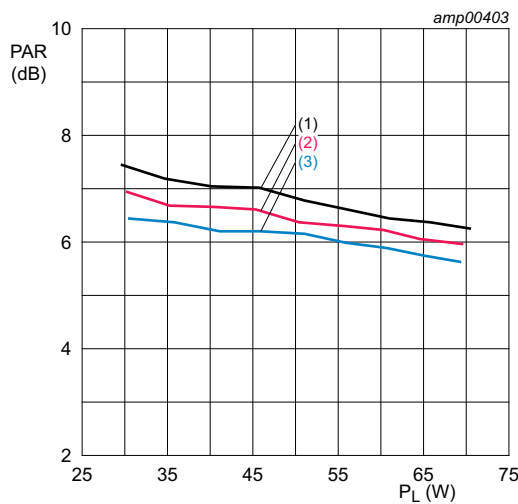
Fig 4. Power gain and drain efficiency as function of output power; typical values



$V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 400\text{ mA}$ ;  $V_{GS(amp)peak} = 1\text{ V}$ .

- (1)  $f = 2496\text{ MHz}$
- (2)  $f = 2600\text{ MHz}$
- (3)  $f = 2690\text{ MHz}$

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



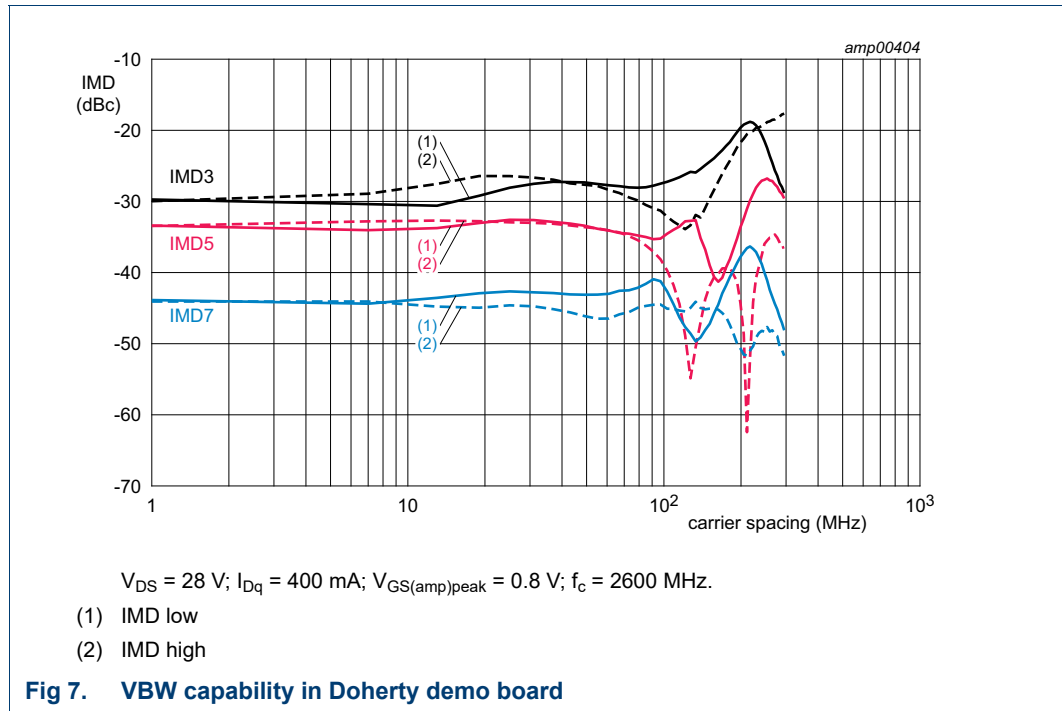
$V_{DS} = 28\text{ V}$ ;  $I_{Dq} = 400\text{ mA}$ ;  $V_{GS(amp)peak} = 1\text{ V}$ .

- (1)  $f = 2496\text{ MHz}$
- (2)  $f = 2600\text{ MHz}$
- (3)  $f = 2690\text{ MHz}$

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



7.5.3 2-Tone VBW



### 8. Package outline

Air cavity plastic earless flanged package; 6 leads

SOT1258-1

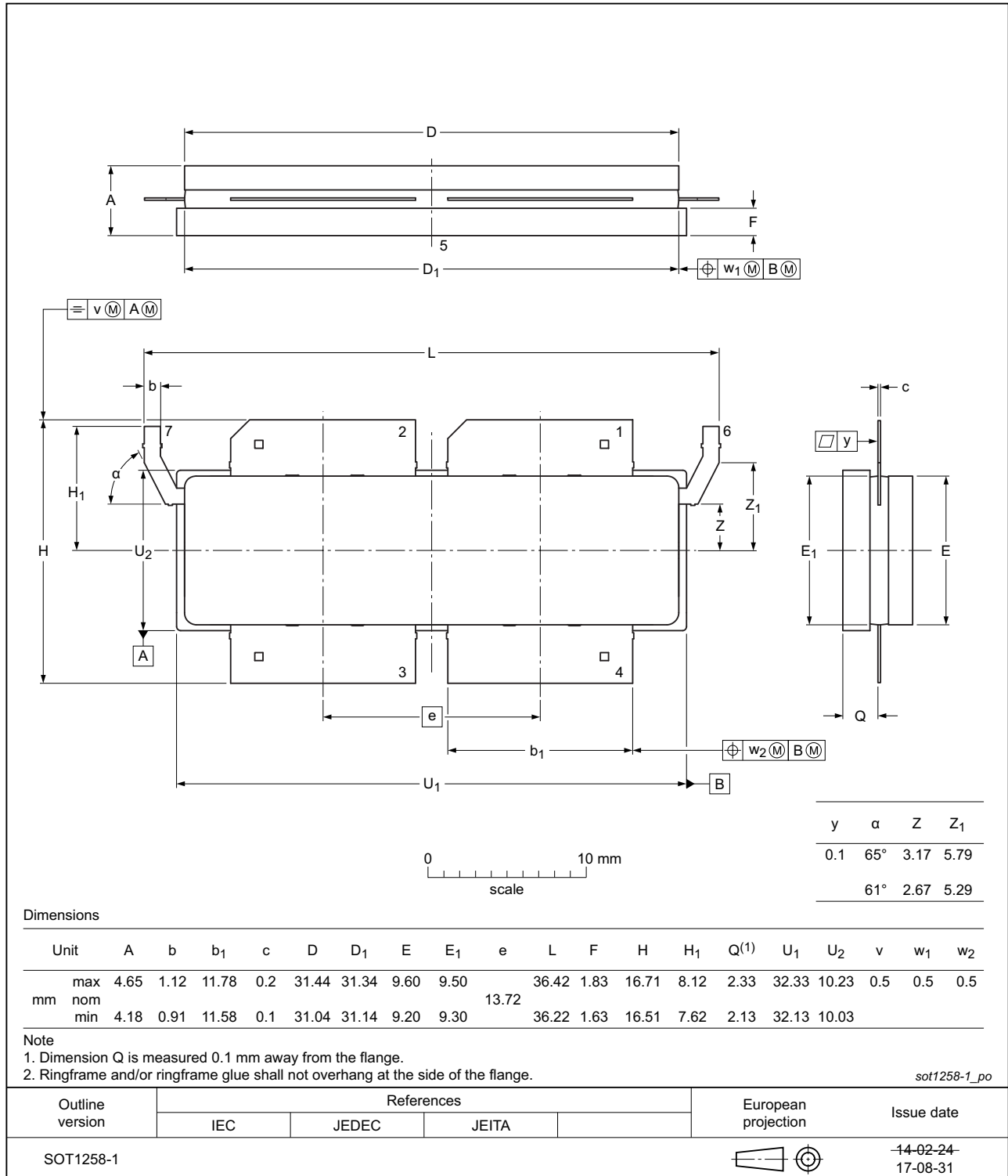



Fig 8. Package outline SOT1258-1

## 9. Handling information

CAUTION	
	<p>This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.</p> <p>Such precautions are described in the <i>ANSI/ESD S20.20</i>, <i>IEC/ST 61340-5</i>, <i>JESD625-A</i> or equivalent standards.</p>

**Table 11. 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 12. 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
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
BLC10G27LS-320AVT v.2	20171201	Product data sheet	-	BLC10G27LS-320AVT v.1
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Table 7 on page 3</a>: value <math>P_{L(AV)}</math> corrected</li> </ul>			
BLC10G27LS-320AVT v.1	20171116	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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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