

BLS2933-100

Microwave power LDMOS transistor

Rev. 2 — 1 September 2015

AMPLEON

Product data sheet

1. Product profile

1.1 General description

100 W LDMOS power transistor (at a supply voltage of 32 V) for S-band radar applications in the 2.9 GHz to 3.3 GHz frequency range.

Table 1: Typical performance

$t_p = 200 \mu\text{s}$; $\delta = 12 \%$; $T_{\text{case}} = 25 \text{ }^\circ\text{C}$; in a class-AB production test circuit.

Mode of operation	f (GHz)	V _{DS} (V)	P _L (W)	G _p (dB)	η_D (%)	I _{Dq} (mA)
class AB	2.9 to 3.3	32	100	8	40	20

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features

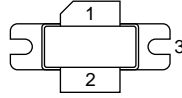
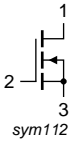
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- Excellent thermal stability
- Designed for broadband operation (2.9 GHz to 3.3 GHz)
- Internally matched for ease of use

1.3 Applications

- S-band radar applications

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	drain		
2	gate		
3	source		

[1] connected to flange

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLS2933-100	-	flanged LDMOST ceramic package; 2 mounting holes; 2 leads	SOT502A

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		-	15	V
I_D	drain current		-	12	A
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature		-	200	°C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$Z_{th(j-h)}$	transient thermal impedance from junction to heatsink	$T_h = 25\text{ °C}$; $t_p = 200\text{ }\mu\text{s}$; $\delta = 12\text{ %}$	0.4	K/W

6. Characteristics

Table 6. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 2.1\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 180\text{ mA}$	2.5	3.1	3.5	V
V_{GSq}	gate-source quiescent voltage	$V_{DS} = 28\text{ V}; I_{DS} = 900\text{ mA}$	-	3.3	4.5	V
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$	-	-	2	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 9\text{ V}; V_{DS} = 10\text{ V}$	27	30	-	A
I_{GSS}	gate leakage current	$V_{GS} = 15\text{ V}; V_{DS} = 0\text{ V}$	-	-	200	nA
g_{fs}	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 10\text{ A}$	-	9.0	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 6\text{ V}; I_D = 6\text{ A}$	-	0.09	-	Ω
C_{rs}	feedback capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}; f = 1\text{ MHz}$	-	2.5	-	pF

7. Application information

Table 7. Application information

RF performance in common source class-AB circuit; $T_h = 25\text{ }^{\circ}\text{C}$; $t_p = 200\text{ }\mu\text{s}$; $\delta = 12\text{ }\%$;

$Z_{th(mb-h)} = 0.15\text{ K/W}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{oper}	operating frequency		2.9	-	3.3	GHz
V_{CC}	supply voltage		-	-	32	V
t_p	pulse duration		-	200	-	μs
δ	duty cycle		-	12	-	%
P_L	output power		100	-	-	W
$P_{L(1dB)}$	output power at 1 dB gain compression		-	120	-	W
G_p	power gain		6	8	-	dB
η_D	drain efficiency		33	40	-	%
$P_{droop(pulse)}$	pulse droop power		-	0.1	0.5	dB
t_r	rise time		-	20	50	ns
t_f	fall time		-	6	50	ns
$VSWR_{load}$	load voltage standing wave ratio		10 : 1	-	-	
IRL	input return loss		-	-10	-	dB

Table 8. Typical impedance

f GHz	Z_S Ω	Z_L Ω
2.9	$3.3 - j5.6$	$3.5 - j3.3$
3.0	$3.7 - j5.3$	$3.1 - j3.6$
3.1	$5.9 - j5.8$	$3.3 - j3.3$
3.2	$6.8 - j3.4$	$3.2 - j3.5$
3.3	$6.6 - j2.7$	$3.1 - j3.6$

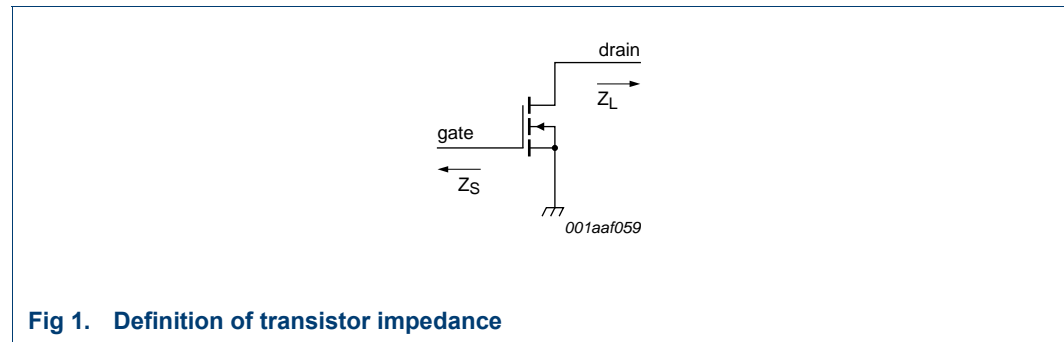
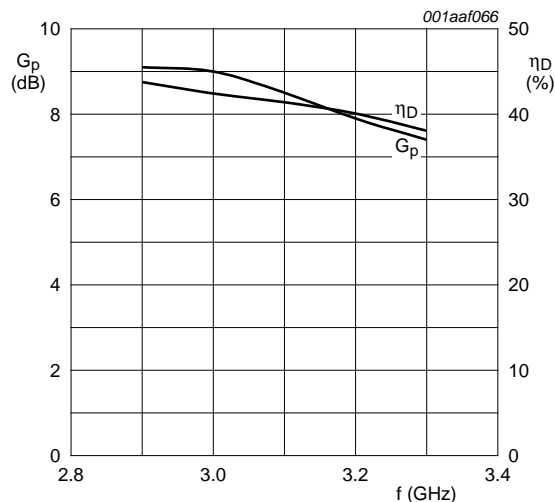


Fig 1. Definition of transistor impedance

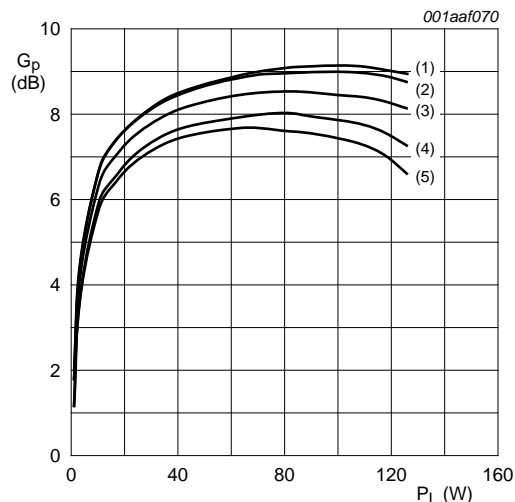
7.1 Ruggedness in class-AB operation

The BLS2933-100 is capable of withstanding a load mismatch corresponding to $VSWR > 10 : 1$ through all phases under the following conditions: $V_{DS} = 32 \text{ V}$; $I_{DQ} = 20 \text{ mA}$; $P_L = 100 \text{ W}$ pulsed, $t_p = 200 \mu\text{s}$; $\delta = 12 \%$.



$V_{DS} = 32 \text{ V}$; $I_{Dq} = 20 \text{ mA}$; $t_p = 200 \text{ } \mu\text{s}$; $\delta = 12 \text{ } \%$;
 $P_L = 100 \text{ W}$.

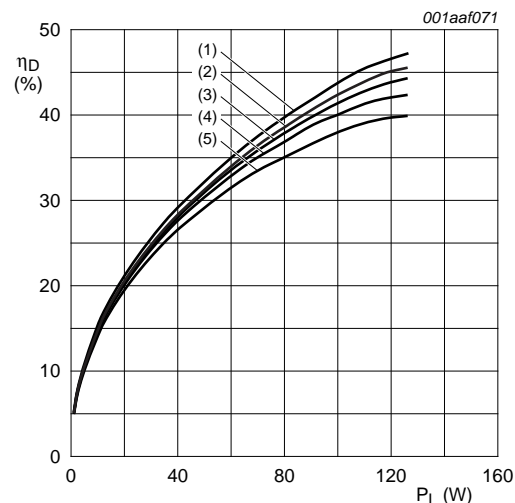
Fig 2. Power gain and drain efficiency as functions of frequency; typical values



- (1) $f = 2.9 \text{ MHz}$.
- (2) $f = 3.0 \text{ MHz}$.
- (3) $f = 3.1 \text{ MHz}$.
- (4) $f = 3.2 \text{ MHz}$.
- (5) $f = 3.3 \text{ MHz}$.

$V_{DS} = 32 \text{ V}$; $I_{Dq} = 20 \text{ mA}$; $t_p = 200 \text{ } \mu\text{s}$; $\delta = 12 \text{ } \%$.

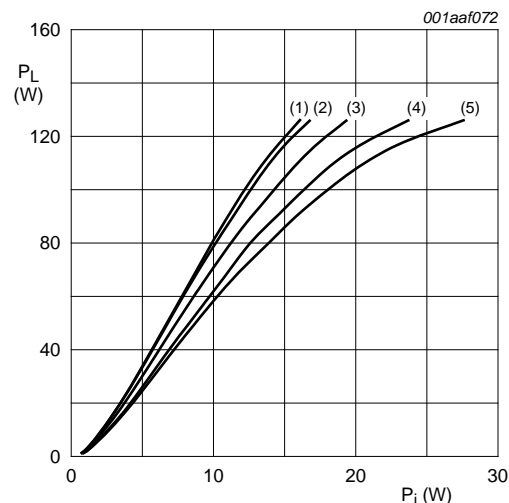
Fig 3. Power gain as a function of load power; typical values



- (1) $f = 2.9 \text{ MHz}$.
- (2) $f = 3.0 \text{ MHz}$.
- (3) $f = 3.1 \text{ MHz}$.
- (4) $f = 3.2 \text{ MHz}$.
- (5) $f = 3.3 \text{ MHz}$.

$V_{DS} = 32 \text{ V}$; $I_{Dq} = 20 \text{ mA}$; $t_p = 200 \text{ } \mu\text{s}$; $\delta = 12 \text{ } \%$.

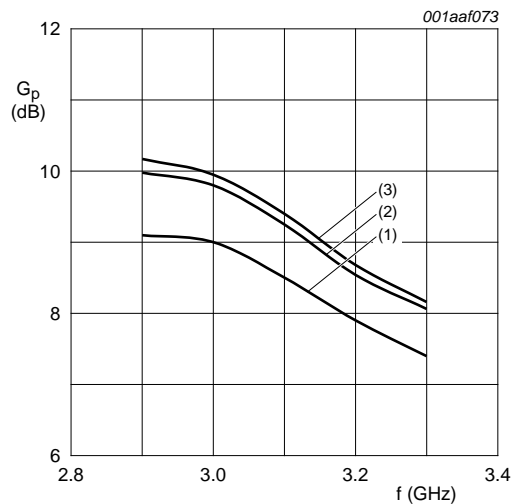
Fig 4. Efficiency as a function of power load; typical values



- (1) $f = 2.9 \text{ MHz}$.
- (2) $f = 3.0 \text{ MHz}$.
- (3) $f = 3.1 \text{ MHz}$.
- (4) $f = 3.2 \text{ MHz}$.
- (5) $f = 3.3 \text{ MHz}$.

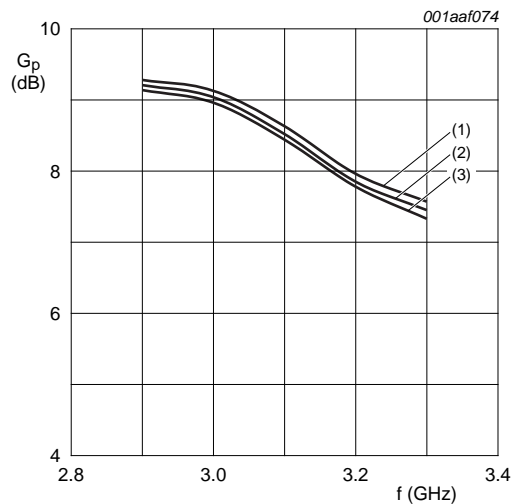
$V_{DS} = 32 \text{ V}$; $I_{Dq} = 20 \text{ mA}$; $t_p = 200 \text{ } \mu\text{s}$; $\delta = 12 \text{ } \%$.

Fig 5. Load power as a function of input power; typical values



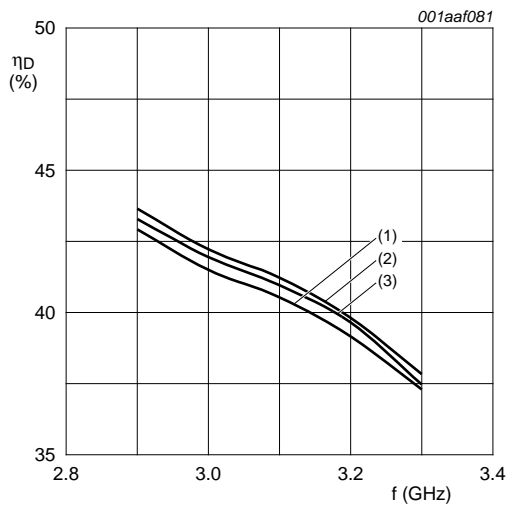
- (1) $I_{Dq} = 20$ mA.
 - (2) $I_{Dq} = 150$ mA.
 - (3) $I_{Dq} = 500$ mA.
- $V_{DS} = 32$ V; $I_{Dq} = 20$ mA; $t_p = 200$ μ s; $\delta = 12$ %;
 $P_L = 100$ W.

Fig 6. Power gain as a function of frequency and I_{Dq} ; typical values



- (1) $t_p = 100$ μ s.
 - (2) $t_p = 300$ μ s.
 - (3) $t_p = 500$ μ s.
- $V_{DS} = 32$ V; $I_{Dq} = 20$ mA; $t_p = 100$ μ s, 200 μ s and 500 μ s; $\delta = 10$ %; $P_L = 100$ W.

Fig 7. Power gain as a function of frequency; typical values



- (1) $t_p = 100$ μ s.
 - (2) $t_p = 300$ μ s.
 - (3) $t_p = 500$ μ s.
- $V_{DS} = 32$ V; $I_{Dq} = 20$ mA; $\delta = 10$ %; $P_L = 100$ W.

Fig 8. Efficiency as a function of frequency; typical values

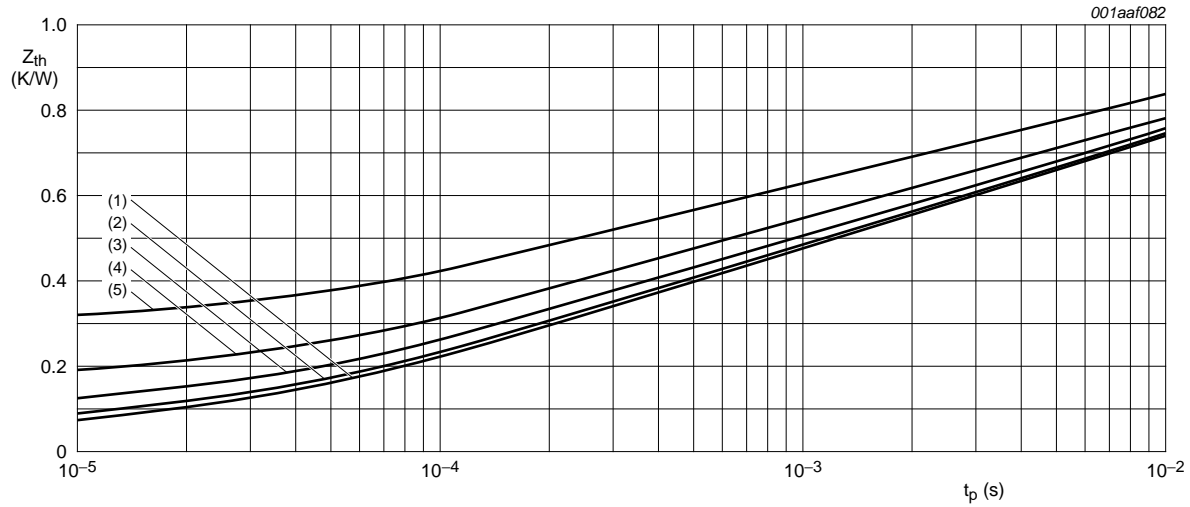
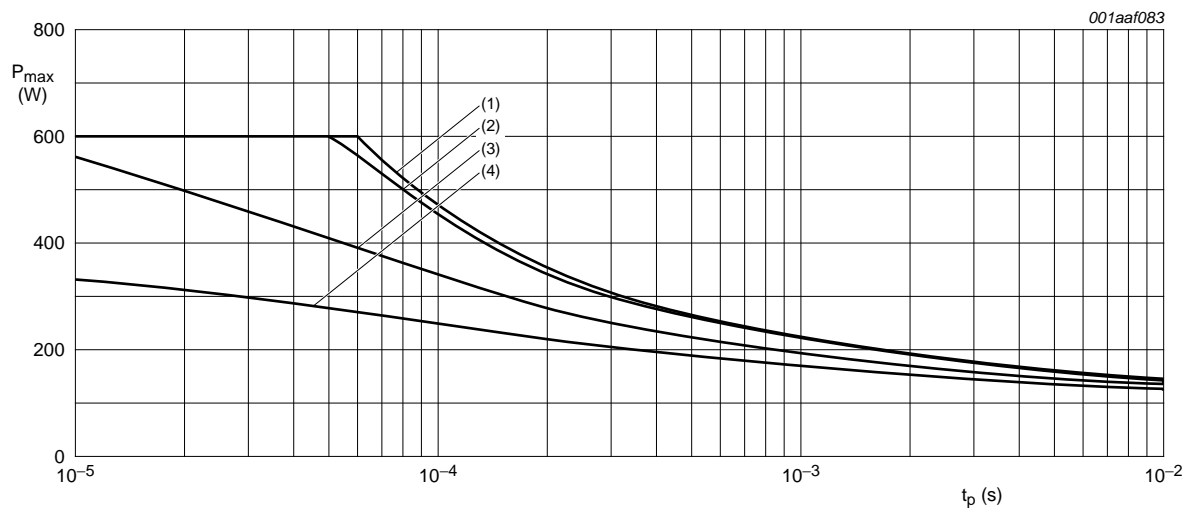


Fig 9. Thermal resistance as function of pulse duration and duty cycle; typical values



$T_h = 70\text{ }^{\circ}\text{C}$

- (1) 1 % duty cycle
- (2) 2 % duty cycle
- (3) 10 % duty cycle
- (4) 20 % duty cycle

Fig 10. Maximum allowable dissipated power as function of pulse duration and duty cycle for reaching 200 °C junction temperature

8. Test information

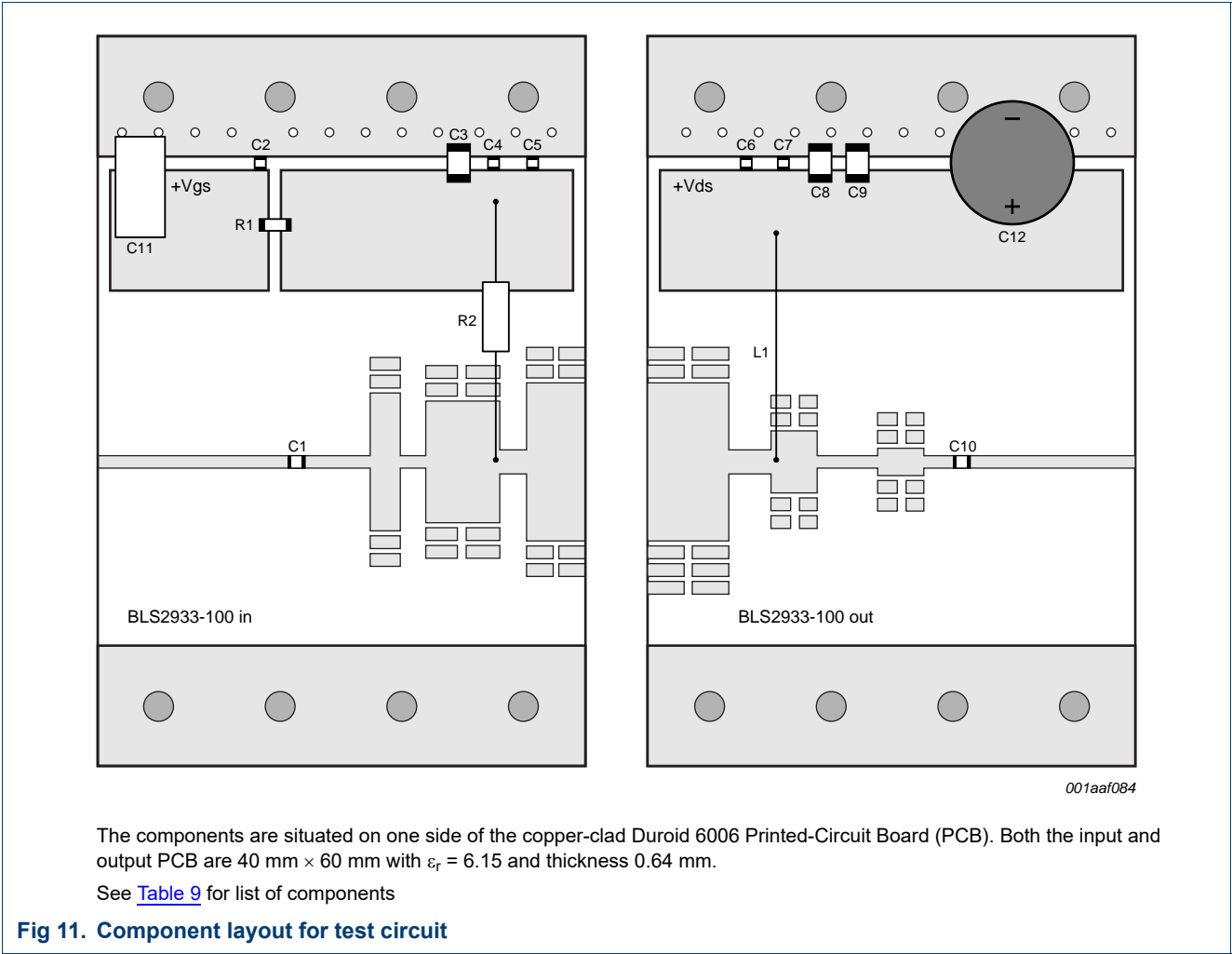


Table 9. List of components (see [Figure 11](#))

Component	Description	Value	Dimensions	Catalogue number
C1, C2, C4, C5, C6, C7, C10	multilayer ceramic chip capacitor [1]	22 pF		
C3, C8, C9	multilayer ceramic chip capacitor [2]	470 pF		
C11	tantalum capacitor	4.7 μ F; 50 V		Kemet T491D475K050AS
C12	electrolytic capacitor	220 μ F; 63 V		
R1	resistor	560 Ω	SMD 0805	
R2	metafilm resistor	49.9 Ω ; 0.6 W		
L1	copper wire 1 mm diameter		length of loop = 20 mm; height of loop = 10 mm	
N1	N-connector male			Suhner 13N-50-057/1
N2	N-connector female			Suhner 23N-50-057/1

[1] American Technical Ceramics type 100A or capacitor of same quality.

[2] American Technical Ceramics type 100B or capacitor of same quality.

9. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads

SOT502A

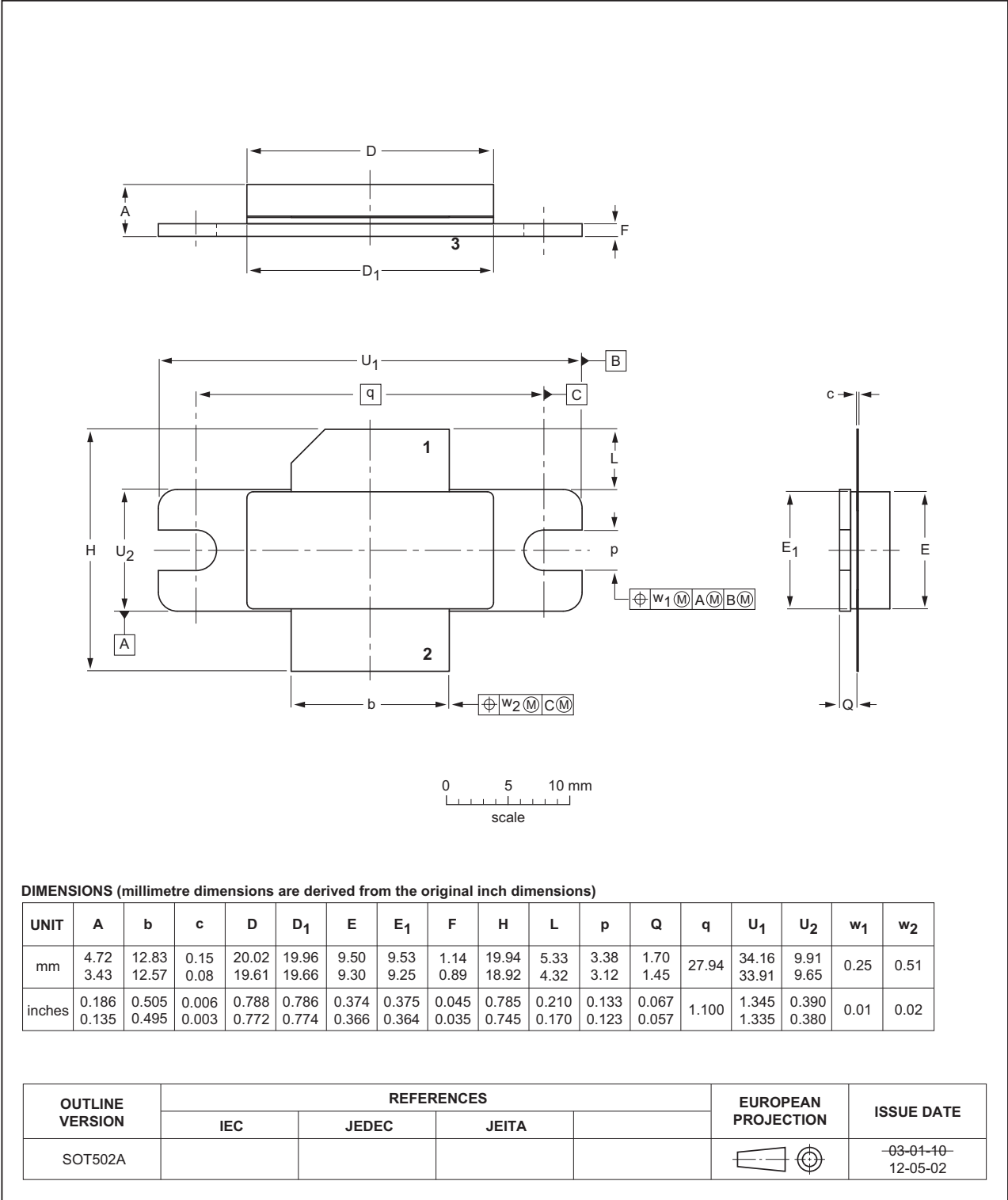


Fig 12. Package outline SOT502A

10. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLS2933-100#2	20150901	Product data sheet	-	BLS2933-100_1
Modifications:	<ul style="list-style-type: none">• 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.			
BLS2933-100_1	20060801	Product data sheet	-	-

11. Legal information

11.1 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".

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Date of release: 1 September 2015
Document identifier: BLS2933-100#2