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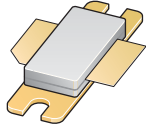
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# BLS2933-100

Microwave power LDMOS transistor

Rev. 2 — 1 September 2015

AMMPLÉON

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**

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

Mode of operation	f (GHz)	V <sub>DS</sub> (V)	P <sub>L</sub> (W)	G <sub>p</sub> (dB)	$\eta_D$ (%)	I <sub>Dq</sub> (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

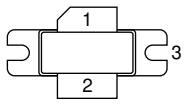
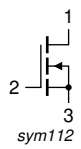
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- Excellent thermal stability
- Designed for broadband operation (2.9 GHz to 3.3 GHz)
- Internally matched for ease of use

### 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		Version
	Name	Description	
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	$\mu\text{A}$
$I_{DSX}$	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	-	$\Omega$
$C_{rs}$	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	-	$\mu\text{s}$
$\delta$	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
$\eta_D$	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 <sub>S</sub> Ω	Z <sub>L</sub> 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

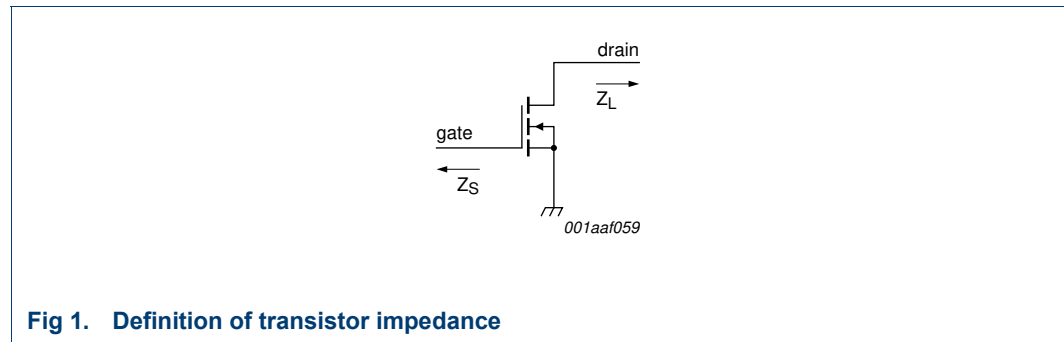
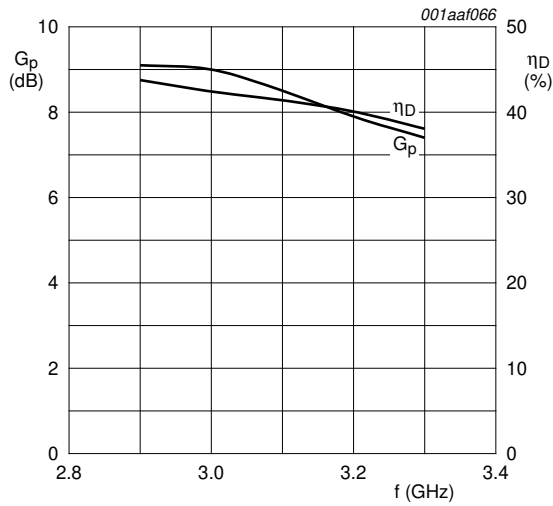


Fig 1. Definition of transistor impedance

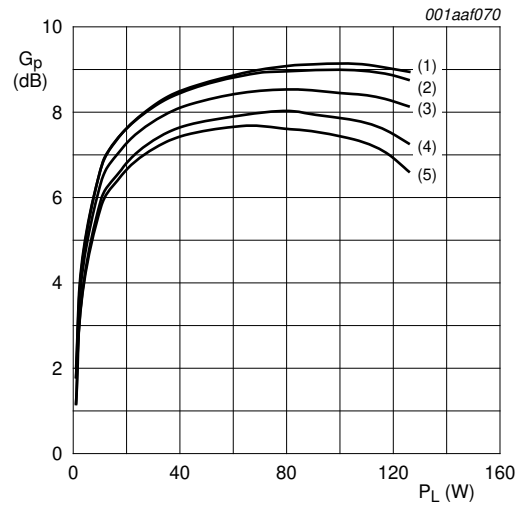
### 7.1 Ruggedness in class-AB operation

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



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

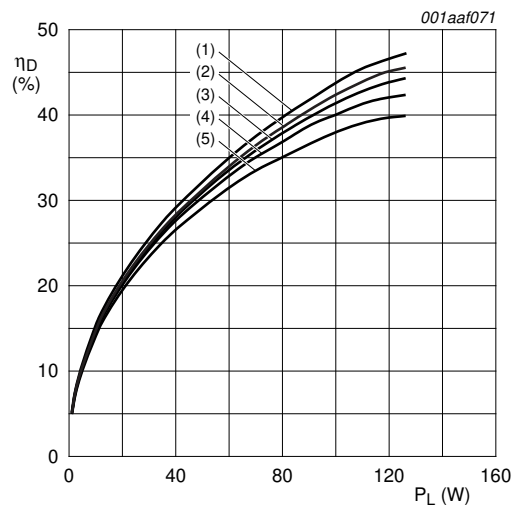
**Fig 2. Power gain and drain efficiency as functions of frequency; typical values**



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

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

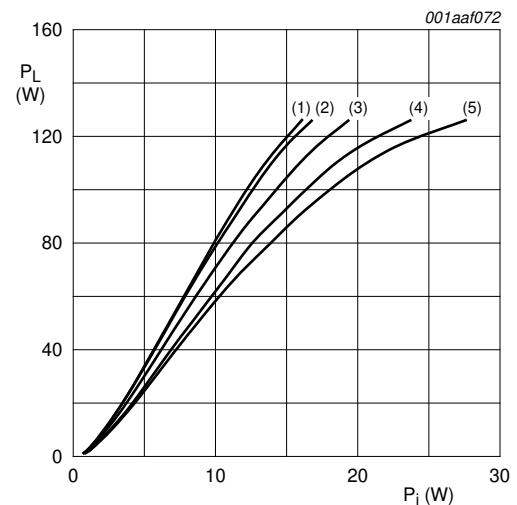
**Fig 3. Power gain as a function of load power; typical values**



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

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

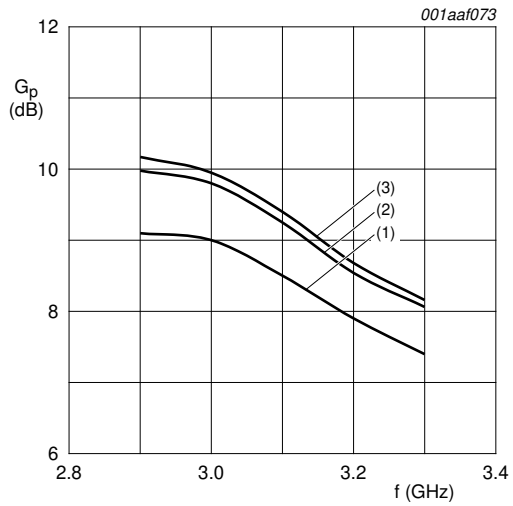
**Fig 4. Efficiency as a function of power load; typical values**



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

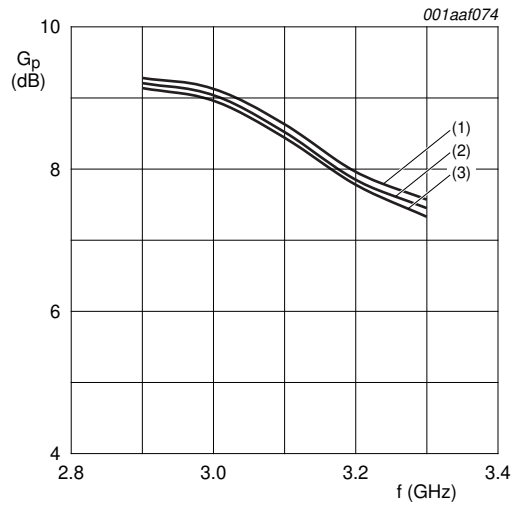
$V_{DS} = 32$  V;  $I_{Dq} = 20$  mA;  $t_p = 200$   $\mu$ s;  $\delta = 12$  %.

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



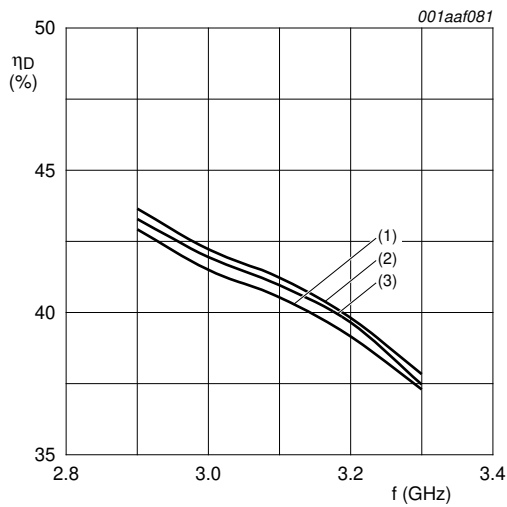
(1)  $I_{Dq} = 20$  mA.  
 (2)  $I_{Dq} = 150$  mA.  
 (3)  $I_{Dq} = 500$  mA.  
 $V_{DS} = 32$  V;  $I_{Dq} = 20$  mA;  $t_p = 200$   $\mu$ s;  $\delta = 12$  %;  
 $P_L = 100$  W.

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



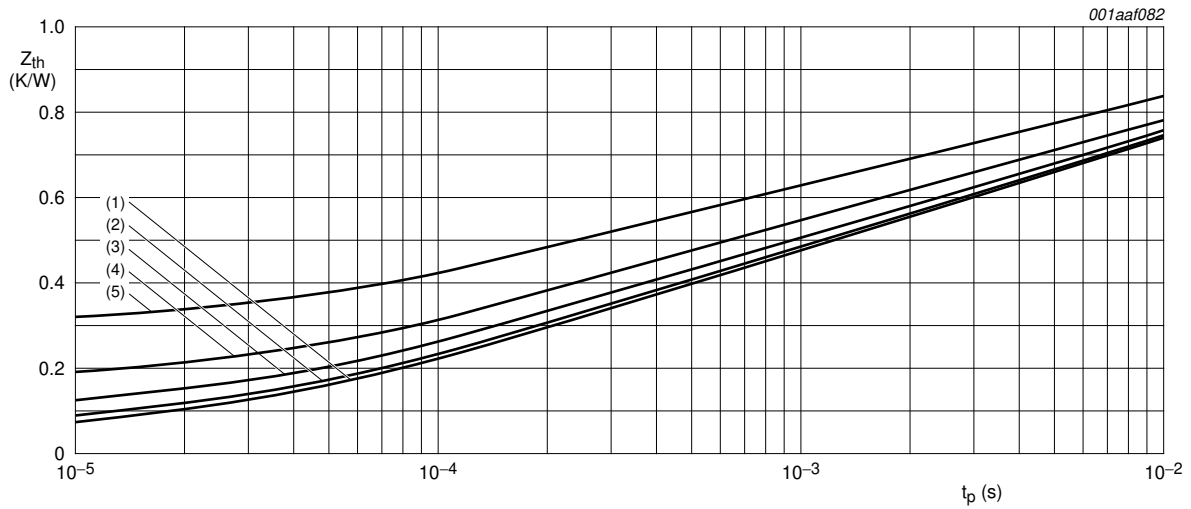
(1)  $t_p = 100$   $\mu$ s.  
 (2)  $t_p = 300$   $\mu$ s.  
 (3)  $t_p = 500$   $\mu$ s.  
 $V_{DS} = 32$  V;  $I_{Dq} = 20$  mA;  $t_p = 100$   $\mu$ s, 200  $\mu$ s and 500  $\mu$ s;  $\delta = 10$  %;  $P_L = 100$  W.

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



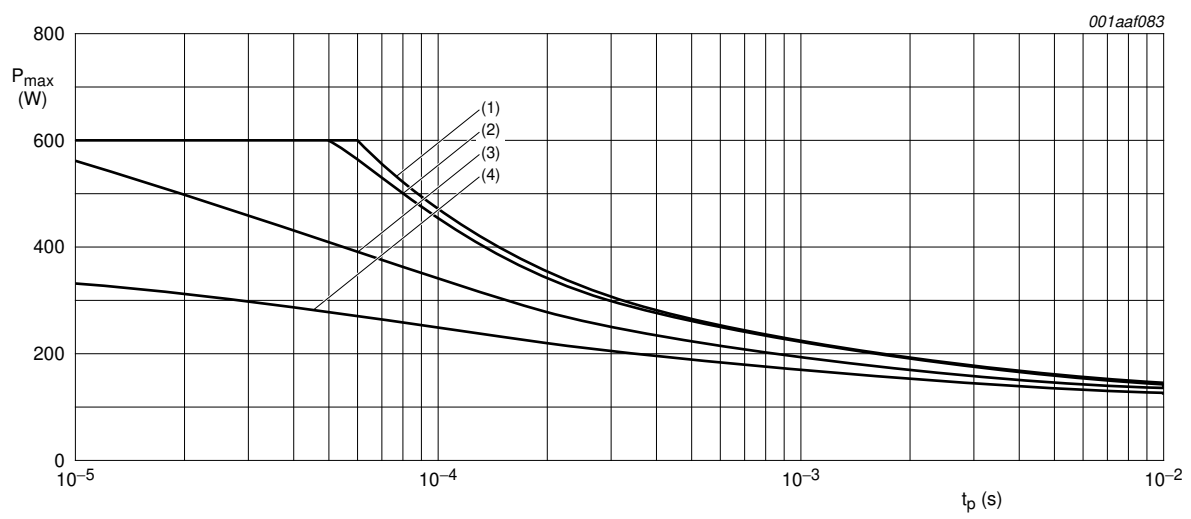
(1)  $t_p = 100$   $\mu$ s.  
 (2)  $t_p = 300$   $\mu$ s.  
 (3)  $t_p = 500$   $\mu$ s.  
 $V_{DS} = 32$  V;  $I_{Dq} = 20$  mA;  $\delta = 10$  %;  $P_L = 100$  W.

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



- (1) 1 % duty cycle
- (2) 2 % duty cycle
- (3) 5 % duty cycle
- (4) 10 % duty cycle
- (5) 20 % duty cycle

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

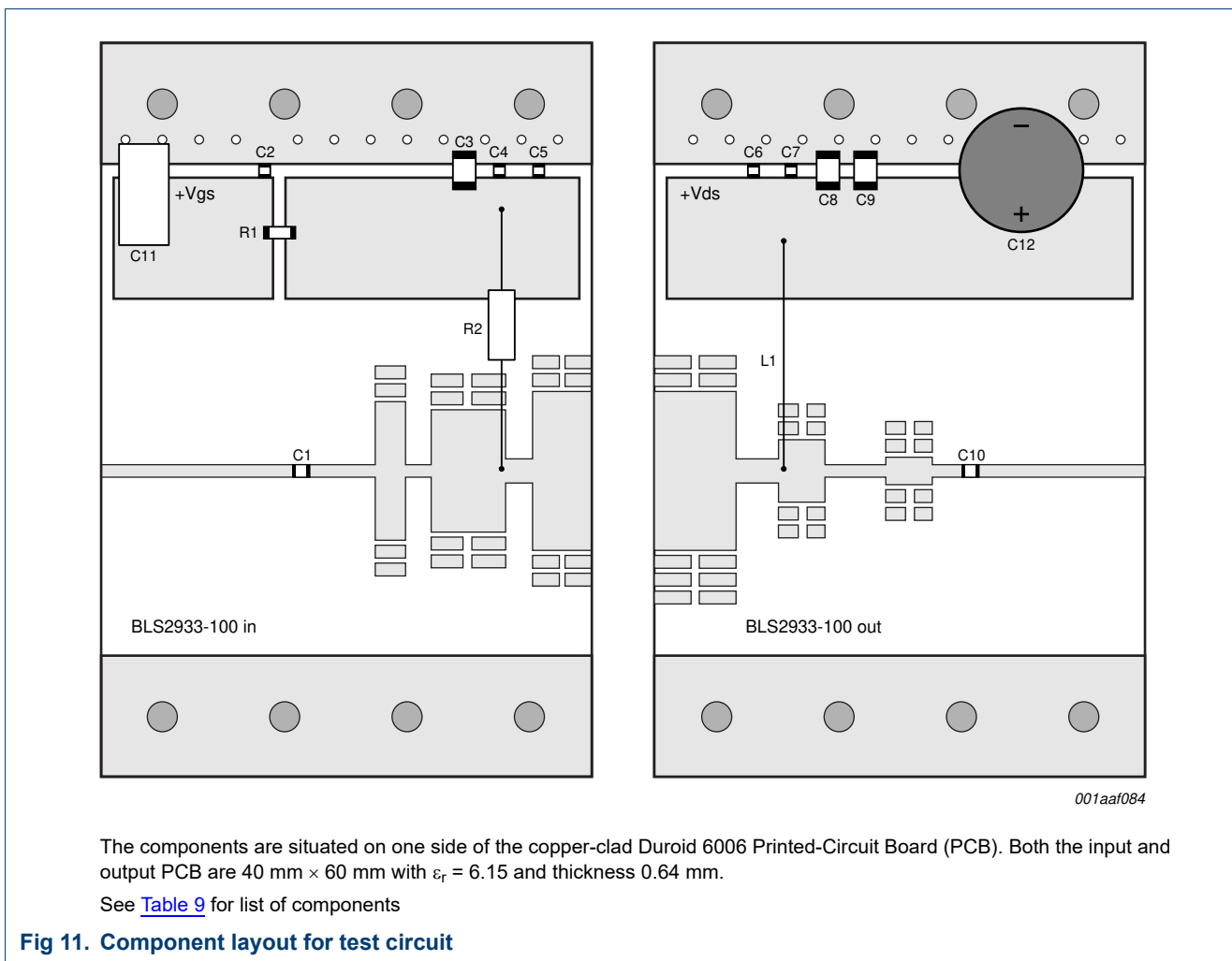


- $T_h = 70\text{ }^\circ\text{C}$
- (1) 1 % duty cycle
  - (2) 2 % duty cycle
  - (3) 10 % duty cycle
  - (4) 20 % duty cycle

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 <a href="#">[1]</a>	22 pF		
C3, C8, C9	multilayer ceramic chip capacitor <a href="#">[2]</a>	470 pF		
C11	tantalum capacitor	4.7 $\mu$ F; 50 V		Kemet T491D475K050AS
C12	electrolytic capacitor	220 $\mu$ F; 63 V		
R1	resistor	560 $\Omega$	SMD 0805	
R2	metafilm resistor	49.9 $\Omega$ ; 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

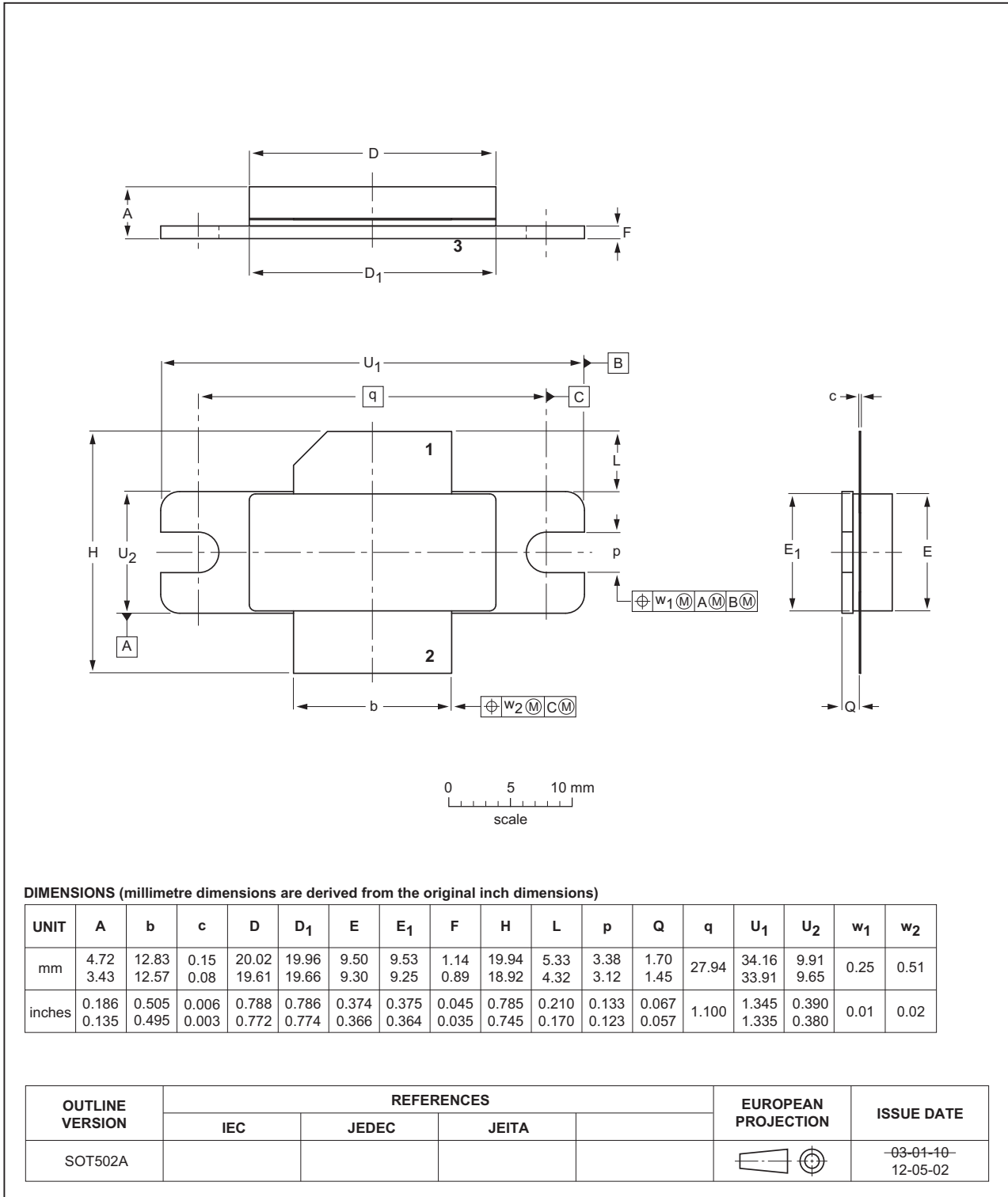


Fig 12. Package outline SOT502A

## 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"><li>• The format of this document has been redesigned to comply with the new identity guidelines of Ampleon.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
BLS2933-100_1	20060801	Product data sheet	-	-

## 11. Legal information

### 11.1 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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