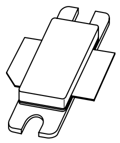


BLS2933-100

Microwave power LDMOS transistor

Rev. 01 — 1 August 2006 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 µs; δ = 12 %; T_{case} = 25 °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

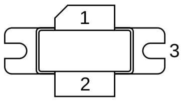
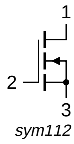
1.3 Applications

- S-band radar applications

PHILIPS

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	drain		
2	gate		
3	source [1]		

[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 °C; t_p = 200 µs; δ = 12 %	0.4	K/W

6. Characteristics

Table 6. Characteristics

T_j = 25 °C unless otherwise specified.

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

7. Application information

Table 7. Application information

RF performance in common source class-AB circuit; T_h = 25 °C; t_p = 200 μs; δ = 12 %; $Z_{th(mb-h)}$ = 0.15 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

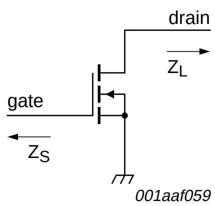
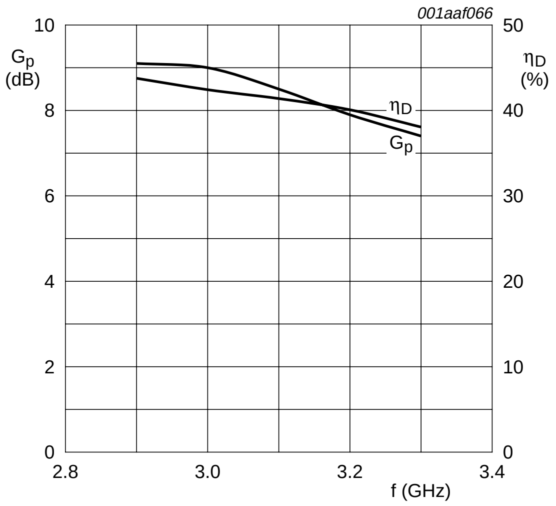


Fig 1. Definition of transistor impedance

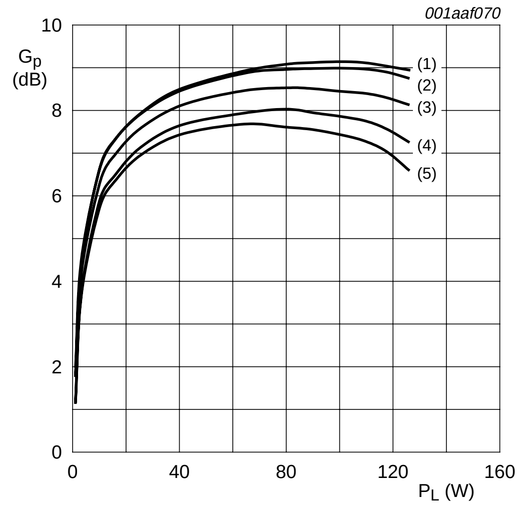
7.1 Ruggedness in class-AB operation

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 V; I_{Dq} = 20 mA; P_L = 100 W pulsed, t_p = 200 μs; δ = 12 %.



V_{DS} = 32 V; I_{Dq} = 20 mA; t_p = 200 μs; δ = 12 %;
P_L = 100 W.

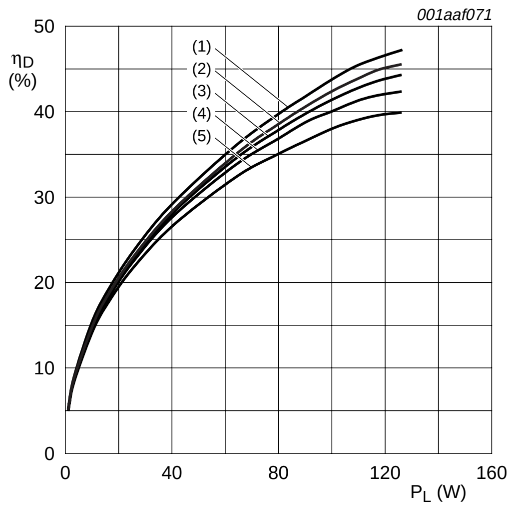
Fig 2. Power gain and drain efficiency as functions of frequency; typical values



(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 μs; δ = 12 %.

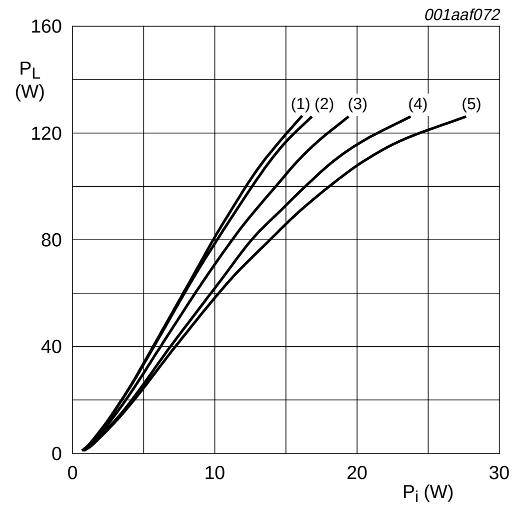
Fig 3. Power gain as a function of load power; typical values



(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 μs; δ = 12 %.

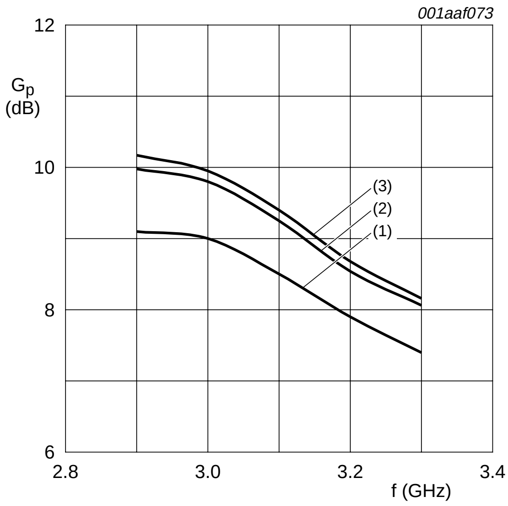
Fig 4. Efficiency as a function of power load; typical values



(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 μs; δ = 12 %.

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



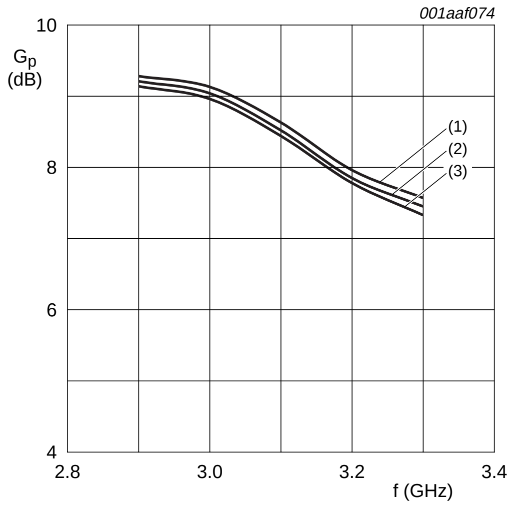
(1) I_{Dq} = 20 mA.

(2) I_{Dq} = 150 mA.

(3) I_{Dq} = 500 mA.

V_{DS} = 32 V; I_{Dq} = 20 mA; t_p = 200 µs; δ = 12 %; P_L = 100 W.

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



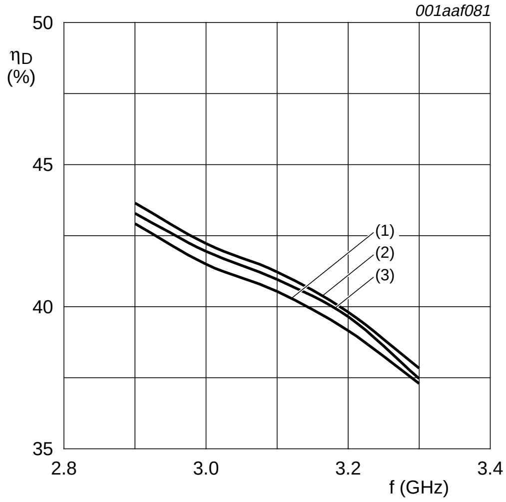
(1) t_p = 100 µs.

(2) t_p = 300 µs.

(3) t_p = 500 µs.

V_{DS} = 32 V; I_{Dq} = 20 mA; t_p = 100 µs, 200 µs and 500 µs; δ = 10 %; P_L = 100 W.

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



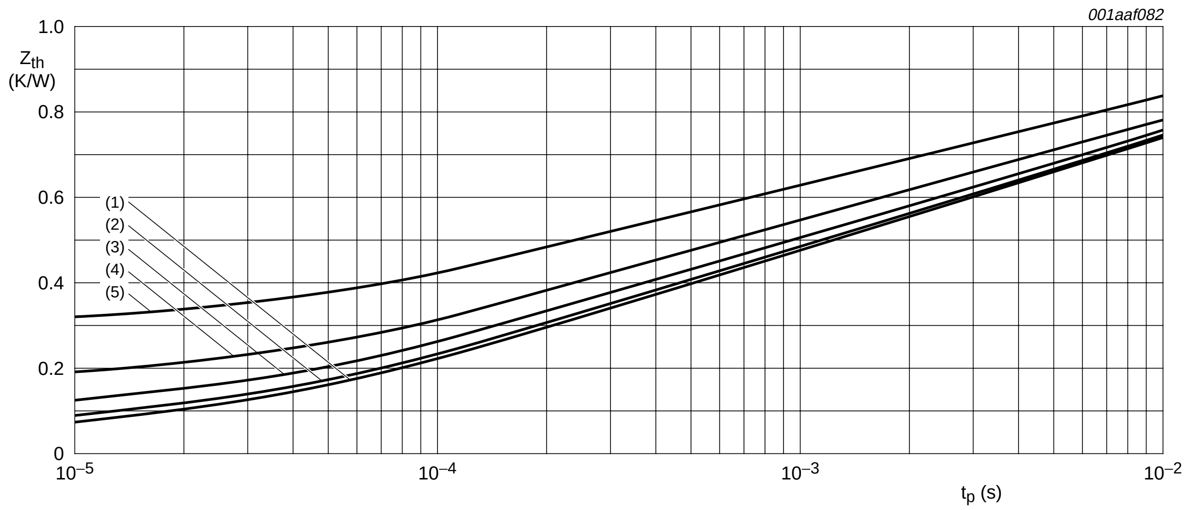
(1) t_p = 100 µs.

(2) t_p = 300 µs.

(3) t_p = 500 µs.

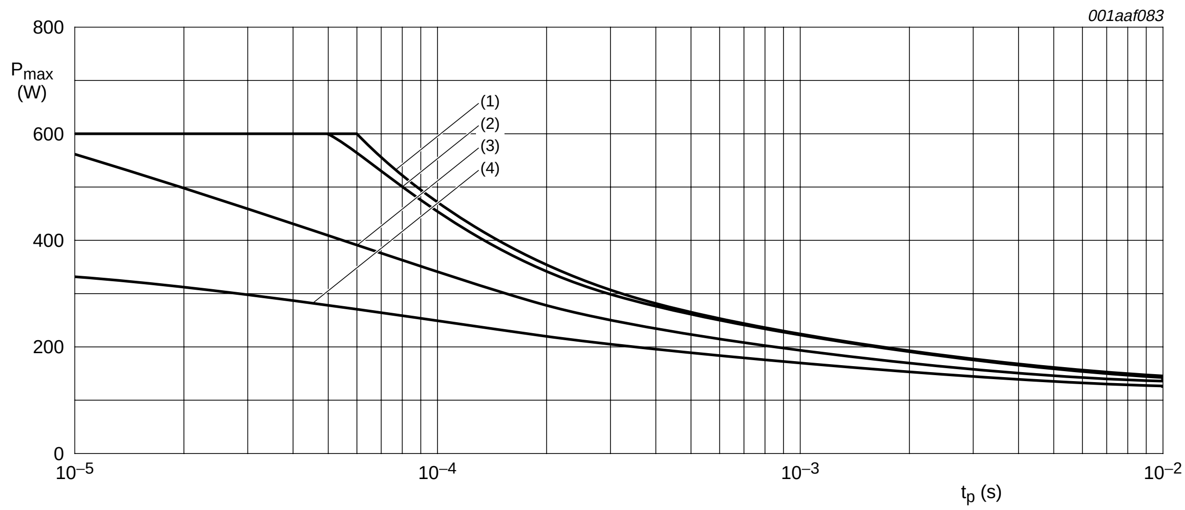
V_{DS} = 32 V; I_{Dq} = 20 mA; δ = 10 %; P_L = 100 W.

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

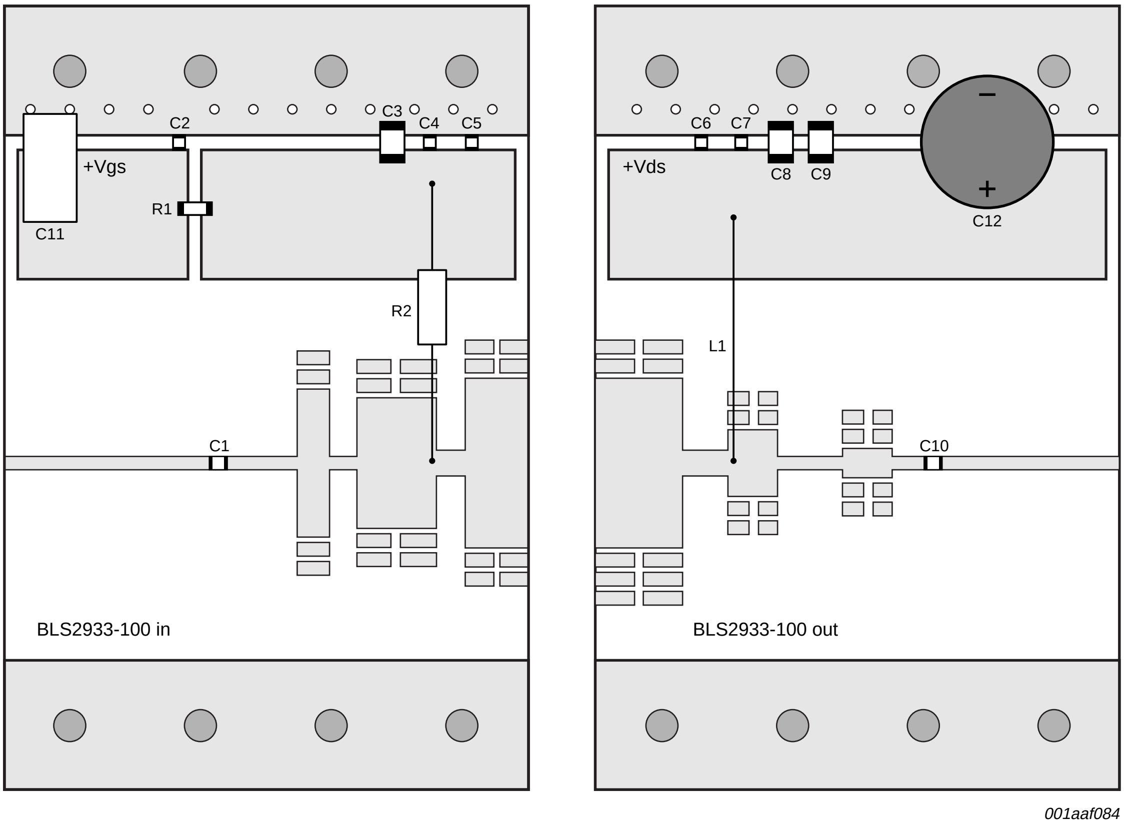
Fig 9. Thermal resistance as function of pulse duration and duty cycle; typical values



T_h = 70 °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



The components are situated on one side of the copper-clad Duroid 6006 Printed-Circuit Board (PCB). Both the input and output PCB are 40 mm × 60 mm with ε_r = 6.15 and thickness 0.64 mm.

See Table 9 for list of components

Fig 11. Component layout for test circuit

Table 9. List of components (see Figure 11)

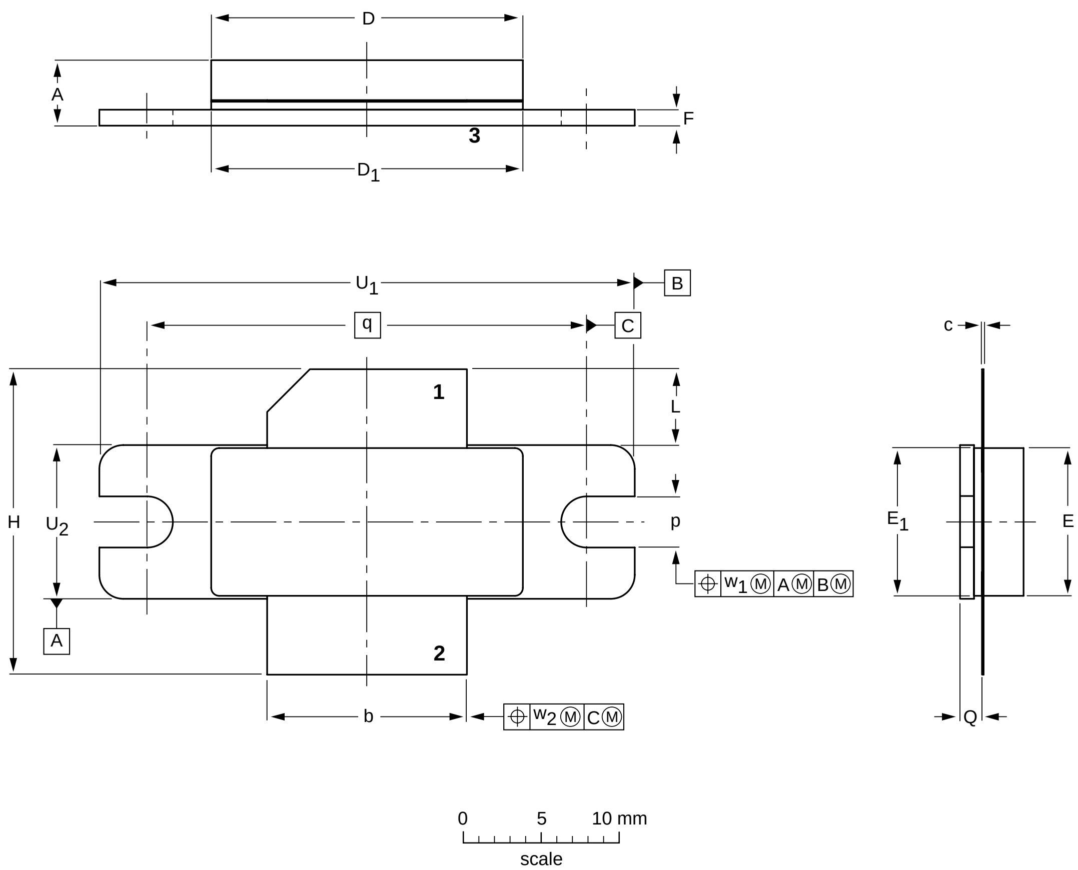
Component	Description	Value	Dimensions	Catalogue number
C1, C2, C4, C5, C6, C7, C10	multilayer ceramic chip capacitor [1]	22 pF		
C3, C8, C9	multilayer ceramic chip capacitor [2]	470 pF		
C11	tantalum capacitor	4.7 μF; 50 V		Kemet T491D475K050AS
C12	electrolytic capacitor	220 μF; 63 V		
R1	resistor	560 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 LDMOST ceramic package; 2 mounting holes; 2 leads **SOT502A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	L	p	Q	q	U_1	U_2	w_1	w_2
mm	4.72 3.43	12.83 12.57	0.15 0.08	20.02 19.61	19.96 19.66	9.50 9.30	9.53 9.25	1.14 0.89	19.94 18.92	5.33 4.32	3.38 3.12	1.70 1.45	27.94	34.16 33.91	9.91 9.65	0.25	0.51
inches	0.186 0.135	0.505 0.495	0.006 0.003	0.788 0.772	0.786 0.774	0.374 0.366	0.375 0.364	0.045 0.035	0.785 0.745	0.210 0.170	0.133 0.123	0.067 0.057	1.100	1.345 1.335	0.390 0.380	0.01	0.02

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT502A						~~99-12-28~~ 03-01-10

Fig 12. Package outline SOT502A

10. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
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".

[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.semiconductors.philips.com.

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Date of release: 1 August 2006

Document identifier: BLS2933-100_1