

BLS7G3135L-350P; BLS7G3135LS-350P

LDMOS S-band radar power transistor

Rev. 3 — 29 October 2013

Product data sheet

1. Product profile

1.1 General description

350 W LDMOS power transistor intended for radar applications in the 3.1 GHz to 3.5 GHz range.

Table 1. Typical performance

Typical RF performance at $T_{case} = 25\text{ °C}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\%$; $I_{Dq} = 200\text{ mA}$; in a class-AB production test circuit.

Test signal	f (GHz)	V _{DS} (V)	P _L (W)	G _p (dB)	η_D (%)	t _r (ns)	t _f (ns)
pulsed RF	3.1	32	350	12	43	5	5
	3.3	32	350	12	43	5	5
	3.5	32	350	10	39	5	5

1.2 Features and benefits

- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (3.1 GHz to 3.5 GHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- S-Band power amplifiers for radar applications in the 3.1 GHz to 3.5 GHz frequency range



2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLS7G3135L-350P (SOT539A)			
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source		
BLS7G3135LS-350P (SOT539B)			
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLS73135L-350P	-	flanged balanced ceramic package; 2 mounting holes; 4 leads	SOT539A
BLS73135LS-350P	-	earless flanged balanced ceramic package; 4 leads	SOT539B

4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Min	Max	Unit
V_{DS}	drain-source voltage	-	65	V
V_{GS}	gate-source voltage	-0.5	+11	V
T_{stg}	storage temperature	-65	+150	°C
T_j	junction temperature	[1]	225	°C

[1] Continuous use at maximum temperature will affect the reliability. For details refer to the on-line MTF calculator.

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$Z_{th(j-mb)}$	transient thermal impedance from junction to mounting base	$T_{case} = 85\text{ °C}; P_L = 350\text{ W}$		
		$t_p = 300\text{ }\mu\text{s}; \delta = 10\%$	0.1	K/W
		$t_p = 100\text{ }\mu\text{s}; \delta = 20\%$	0.09	K/W
		$t_p = 100\text{ }\mu\text{s}; \delta = 10\%$	0.07	K/W
		$t_p = 200\text{ }\mu\text{s}; \delta = 10\%$	0.09	K/W

6. Characteristics

Table 6. DC characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 2.2\text{ mA}$	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 220\text{ mA}$	1.5	1.9	2.3	V
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 28\text{ V}$	-	-	2.8	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$	-	39	-	A
I_{GSS}	gate leakage current	$V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$	-	-	280	nA
g_{fs}	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 11\text{ A}$	-	16.2	-	S
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 7.7\text{ A}$	-	0.065	-	Ω

Table 7. RF characteristics

Test signal: pulsed RF; $t_p = 300 \mu\text{s}$; $\delta = 10\%$; RF performance at $V_{DS} = 32\text{ V}$; $I_{DQ} = 200\text{ mA}$; $T_{case} = 25\text{ }^\circ\text{C}$; unless otherwise specified, in a class-AB production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
At frequency of 3.1 GHz						
G_p	power gain	$P_L = 350\text{ W}$	10.5	12	-	dB
RL_{in}	input return loss	$P_L = 350\text{ W}$	-	-6	-	dB
η_D	drain efficiency	$P_L = 350\text{ W}$	38	43	-	%
$P_{droop(pulse)}$	pulse droop power	$P_L = 350\text{ W}$	-	0.2	0.3	dB
t_r	rise time	$P_L = 350\text{ W}$	-	5	50	ns
t_f	fall time	$P_L = 350\text{ W}$	-	5	50	ns
At frequency of 3.3 GHz						
G_p	power gain	$P_L = 350\text{ W}$	10.5	12	-	dB
RL_{in}	input return loss	$P_L = 350\text{ W}$	-	-6	-	dB
η_D	drain efficiency	$P_L = 350\text{ W}$	38	43	-	%
$P_{droop(pulse)}$	pulse droop power	$P_L = 350\text{ W}$	-	0.2	0.3	dB
t_r	rise time	$P_L = 350\text{ W}$	-	5	50	ns
t_f	fall time	$P_L = 350\text{ W}$	-	5	50	ns
At frequency of 3.5 GHz						
G_p	power gain	$P_L = 320\text{ W}$	8.5	10	-	dB
RL_{in}	input return loss	$P_L = 320\text{ W}$	-	-9	-	dB
η_D	drain efficiency	$P_L = 320\text{ W}$	35	39	-	%
$P_{droop(pulse)}$	pulse droop power	$P_L = 320\text{ W}$	-	0.2	0.3	dB
t_r	rise time	$P_L = 320\text{ W}$	-	5	50	ns
t_f	fall time	$P_L = 320\text{ W}$	-	5	50	ns

7. Application information

7.1 Ruggedness in class-AB operation

The BLS7G3135L-350P and the BLS7G3135LS-350P are capable of withstanding a load mismatch corresponding to $V_{SWR} = 10 : 1$ through all phases under the following conditions: $V_{DS} = 32\text{ V}$; $I_{DQ} = 200\text{ mA}$; $P_L = 350\text{ W}$; $t_p = 300\text{ } \mu\text{s}$; $\delta = 10\%$

7.2 Impedance information

Table 8. Typical impedance

Measured load-pull data. Typical values unless otherwise specified.

f (GHz)	Z_S ^[1] (Ω)	Z_L ^[1] (Ω)
3.1	1.8 – 7.2j	3.6 – 6.3j
3.2	1.6 – 7.1j	4.4 – 6.7j
3.3	2.2 – 8.2j	4.8 – 5.8j
3.4	3.1 – 9.7j	5.7 – 6.2j
3.5	3.6 – 11.6j	6.5 – 4.6j

[1] Impedances are taken at a single half of the push-pull transistor.

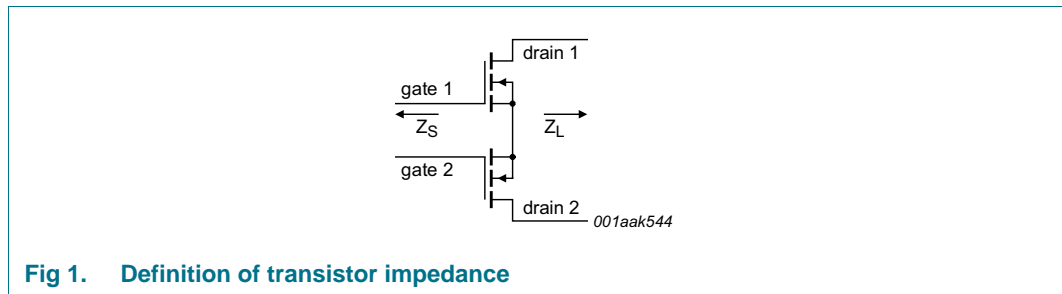
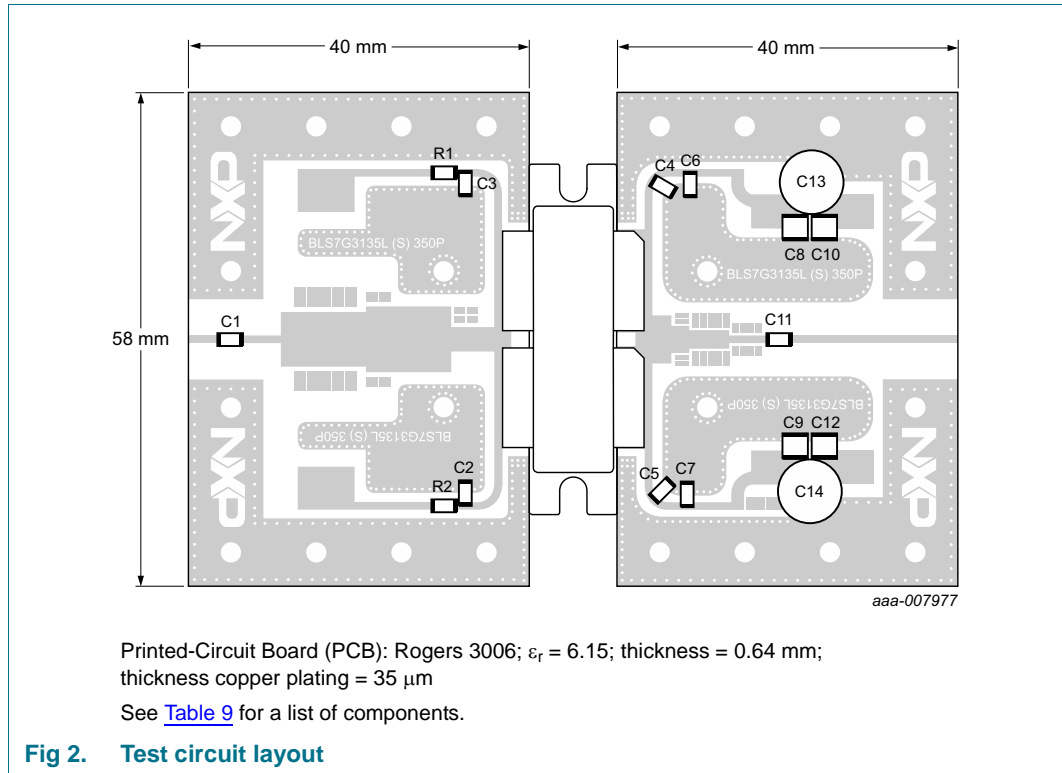


Fig 1. Definition of transistor impedance

7.3 Test circuit information



Printed-Circuit Board (PCB): Rogers 3006; $\epsilon_r = 6.15$; thickness = 0.64 mm; thickness copper plating = 35 μm

See [Table 9](#) for a list of components.

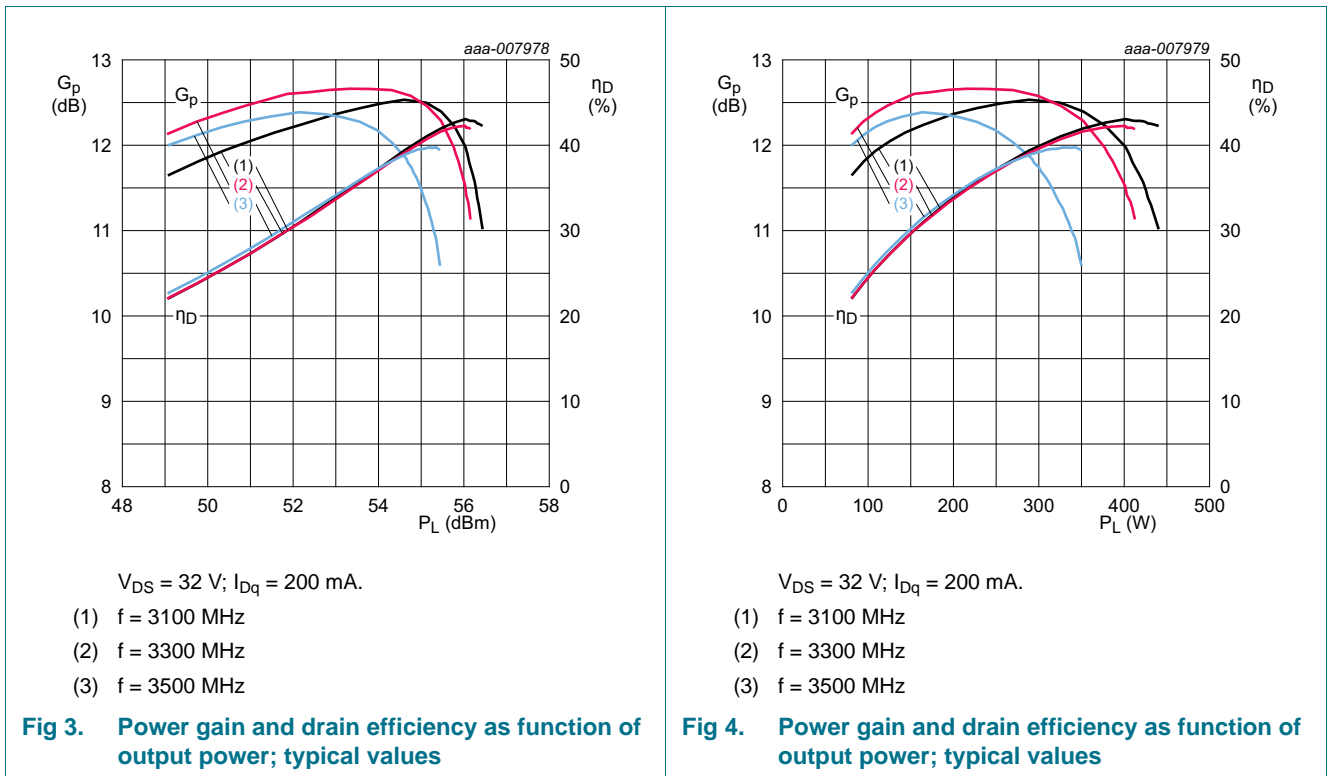
Fig 2. Test circuit layout

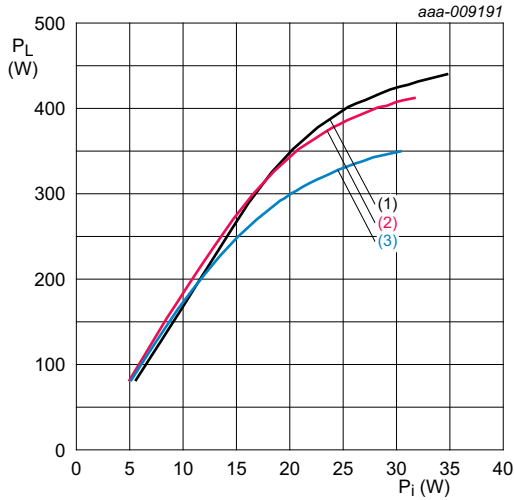
Table 9. List of components

For test circuit see [Figure 2](#).

Component	Description	Value	Remarks
C1, C2, C3	multilayer ceramic chip capacitor	8.2 pF	ATC100A
C4, C5, C11	multilayer ceramic chip capacitor	15 pF	ATC800B
C6, C7	multilayer ceramic chip capacitor	100 pF	ATC800A
C8, C9	multilayer ceramic chip capacitor	1 μ F, 50 V	TDK
C10, C12	multilayer ceramic chip capacitor	10 μ F, 50 V	TDK
C13, C14	electrolytic capacitor	220 μ F, 63 V	
R1, R2	SMD resistor	10 Ω	

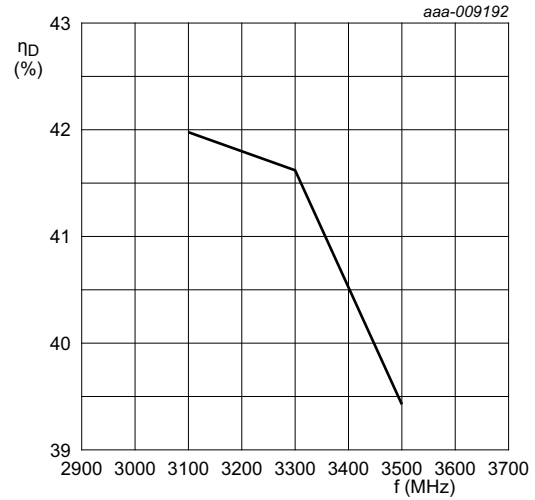
7.4 Graphical data





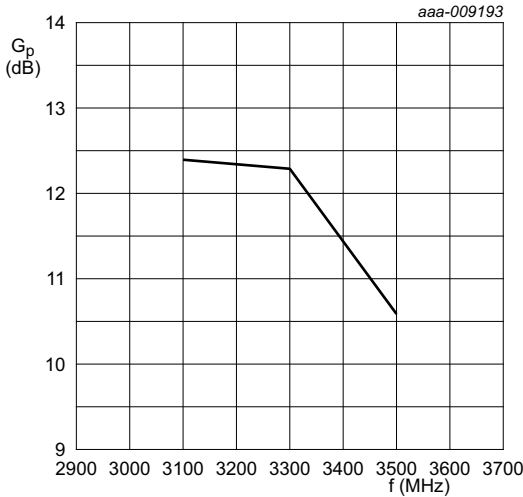
$V_{DS} = 32\text{ V}$; $I_{DQ} = 200\text{ mA}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$.
 (1) $f = 3100\text{ MHz}$
 (2) $f = 3300\text{ MHz}$
 (3) $f = 3500\text{ MHz}$

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



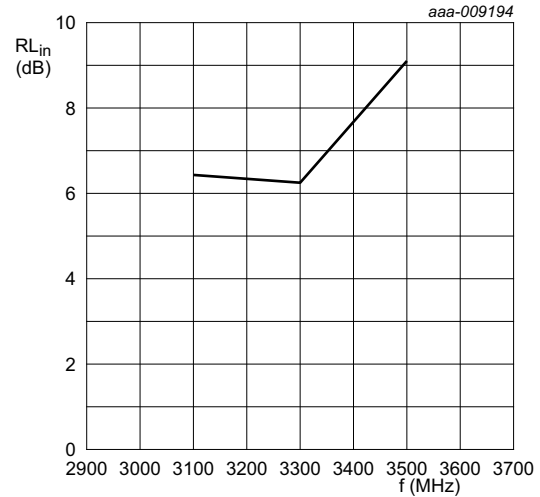
$V_{DS} = 32\text{ V}$; $I_{DQ} = 200\text{ mA}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$;
 $P_L = 350\text{ W}$.

Fig 6. Drain efficiency as a function of frequency; typical values



$V_{DS} = 32\text{ V}$; $I_{DQ} = 200\text{ mA}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$;
 $P_L = 350\text{ W}$.

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



$V_{DS} = 32\text{ V}$; $I_{DQ} = 200\text{ mA}$; $t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$;
 $P_L = 350\text{ W}$.

Fig 8. Input return loss as a function of frequency; typical values

8. Package outline

Flanged balanced ceramic package; 2 mounting holes; 4 leads

SOT539A

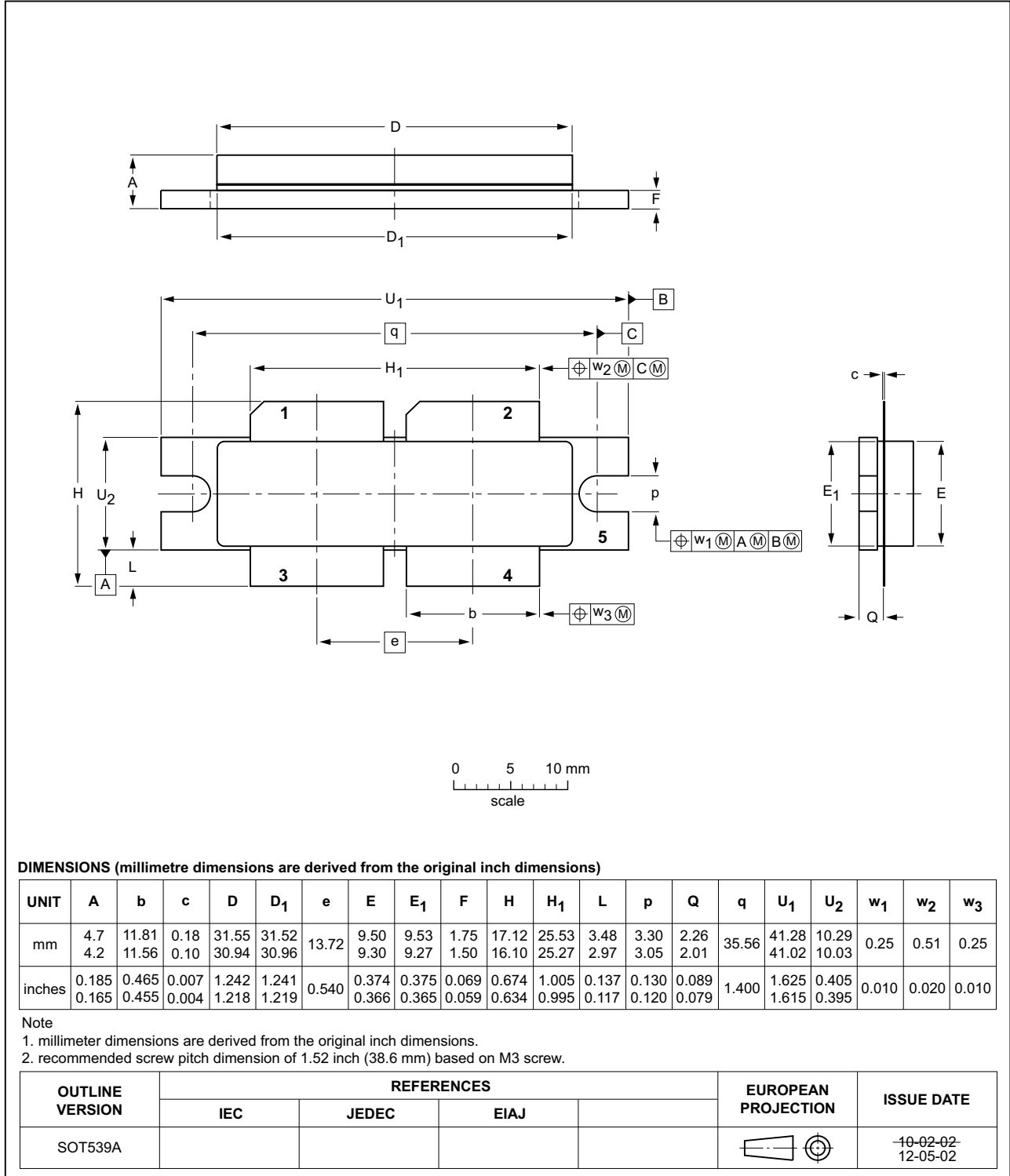


Fig 9. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads

SOT539B

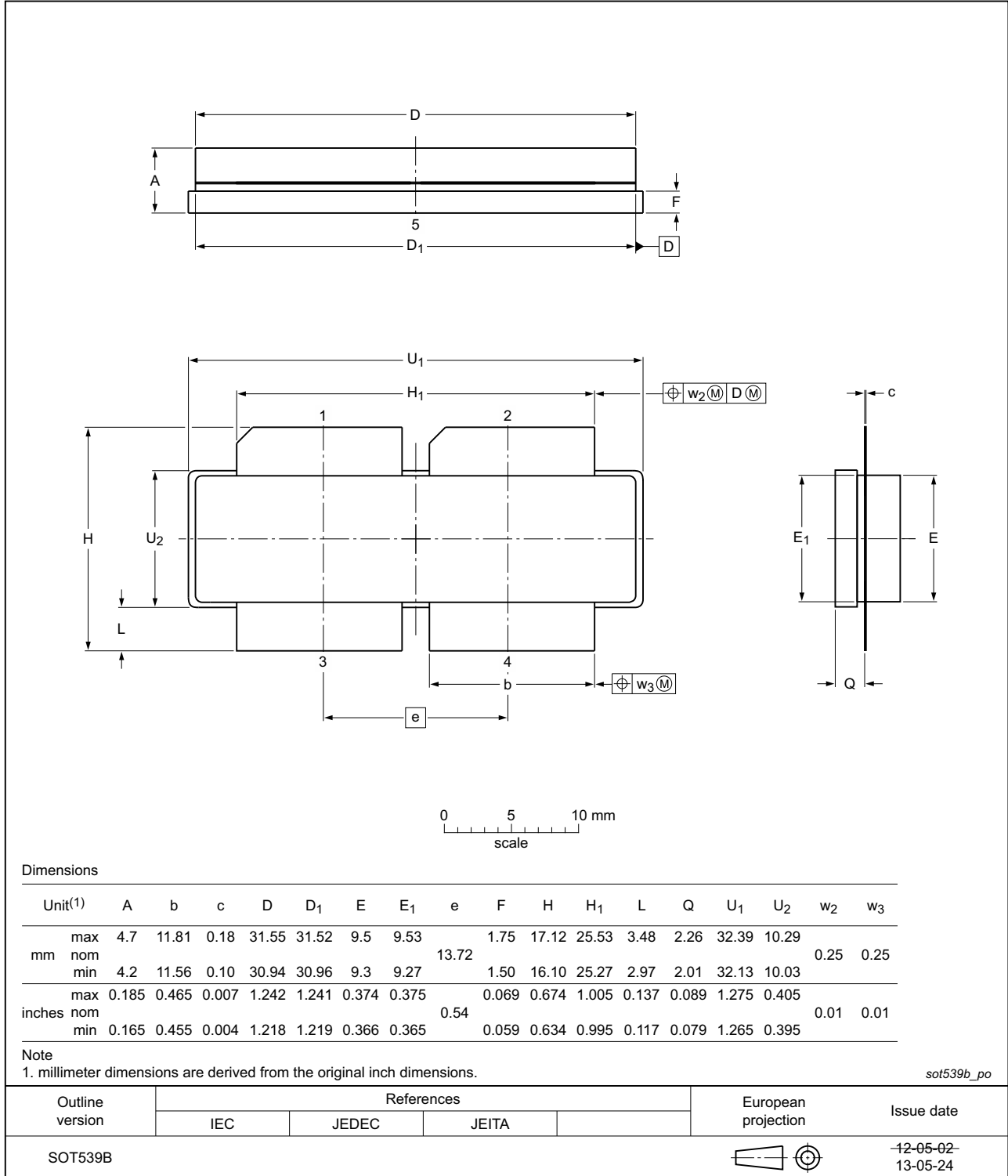


Fig 10. Package outline SOT539B

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.

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
LDMOS	Laterally Diffused Metal Oxide Semiconductor
S-Band	Short wave band
SMD	Surface Mounted Device
VSWR	Voltage Standing-Wave Ratio

11. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLS73135L-350P_7G3135LS-350P v.3	20131029	Product data sheet	-	BLS73135L-350P_7G3135LS-350P v.2
Modifications		<ul style="list-style-type: none"> • Table 1 on page 1: table updated • Table 6 on page 3: table updated • Table 7 on page 4: table updated • Section 7.4 on page 6: 4 graphs added 		
BLS73135L-350P_7G3135LS-350P v.2	20130801	Objective data sheet	-	BLS73135L-350P_7G3135LS-350P v.1
BLS73135L-350P_7G3135LS-350P v.1	20121012	Objective data sheet	-	-

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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.

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

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Date of release: 29 October 2013
 Document identifier: BLS7G3135L-350P_7G3135LS-350P