

# BLS7G3135L-350P; BLS7G3135LS-350P

LDMOS S-band radar power transistor

Rev. 4 — 1 September 2015

AMPLEON

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 <sub>DS</sub> (V)	P <sub>L</sub> (W)	G <sub>p</sub> (dB)	$\eta_D$ (%)	t <sub>r</sub> (ns)	t <sub>f</sub> (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

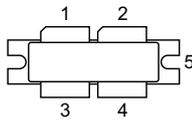
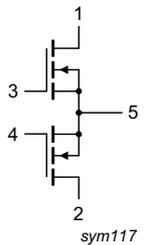
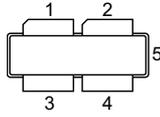
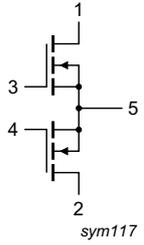
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (3.1 GHz to 3.5 GHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding 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
<b>BLS7G3135L-350P (SOT539A)</b>			
1	drain1		 sym117
2	drain2		
3	gate1		
4	gate2		
5	source		
<b>BLS7G3135LS-350P (SOT539B)</b>			
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	$T_{case} = 85\text{ °C}; P_L = 350\text{ W}$		
		$t_p = 300\text{ }\mu\text{s}; \delta = 10\text{ }\%$	0.1	K/W
		$t_p = 100\text{ }\mu\text{s}; \delta = 20\text{ }\%$	0.09	K/W
		$t_p = 100\text{ }\mu\text{s}; \delta = 10\text{ }\%$	0.07	K/W
		$t_p = 200\text{ }\mu\text{s}; \delta = 10\text{ }\%$	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	$\mu\text{A}$
$I_{DSX}$	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	-	$\Omega$

**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
<b>At frequency of 3.1 GHz</b>						
$G_p$	power gain	$P_L = 350 \text{ W}$	10.5	12	-	dB
$RL_{in}$	input return loss	$P_L = 350 \text{ W}$	-	-6	-	dB
$\eta_D$	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
<b>At frequency of 3.3 GHz</b>						
$G_p$	power gain	$P_L = 350 \text{ W}$	10.5	12	-	dB
$RL_{in}$	input return loss	$P_L = 350 \text{ W}$	-	-6	-	dB
$\eta_D$	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
<b>At frequency of 3.5 GHz</b>						
$G_p$	power gain	$P_L = 320 \text{ W}$	8.5	10	-	dB
$RL_{in}$	input return loss	$P_L = 320 \text{ W}$	-	-9	-	dB
$\eta_D$	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:  $V_{DS} = 32 \text{ V}$ ;  $I_{DQ} = 200 \text{ mA}$ ;  $P_L = 350 \text{ W}$ ;  $t_p = 300 \mu\text{s}$ ;  $\delta = 10 \%$

7.2 Impedance information

Table 8. Typical impedance

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

f (GHz)	Z <sub>S</sub> <sup>[1]</sup> (Ω)	Z <sub>L</sub> <sup>[1]</sup> (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.

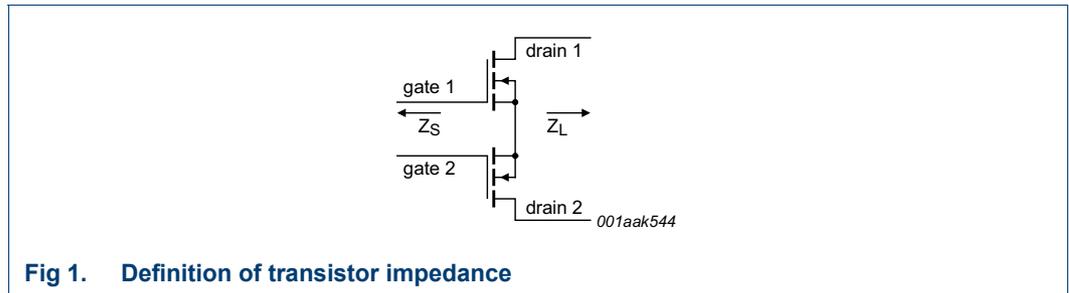
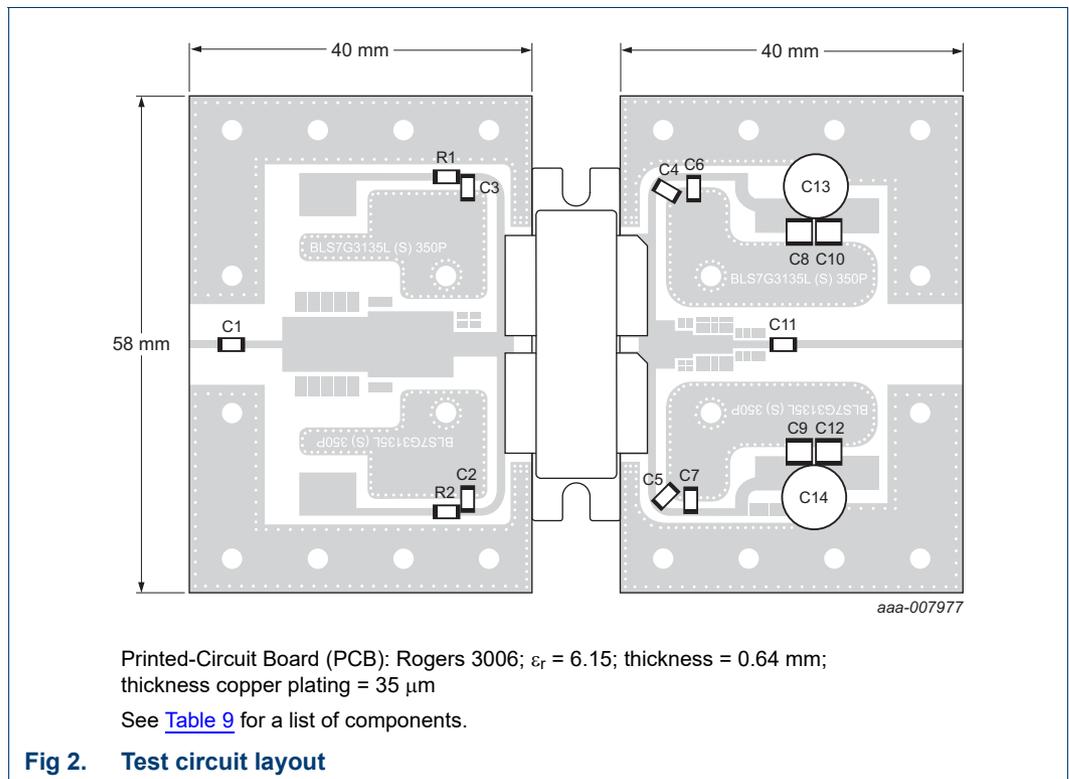


Fig 1. Definition of transistor impedance

7.3 Test circuit information



Printed-Circuit Board (PCB): Rogers 3006;  $\epsilon_r = 6.15$ ; thickness = 0.64 mm; thickness copper plating = 35  $\mu\text{m}$

See Table 9 for a list of components.

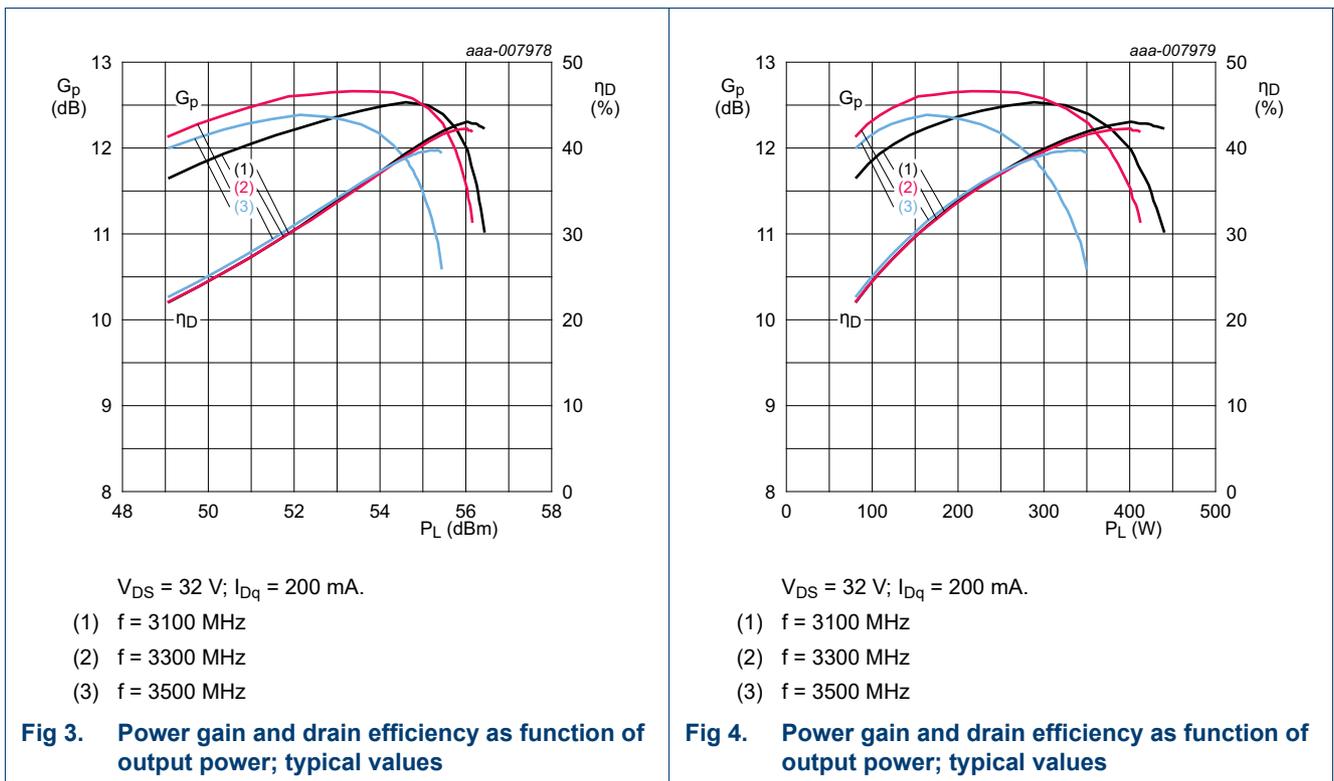
Fig 2. Test circuit layout

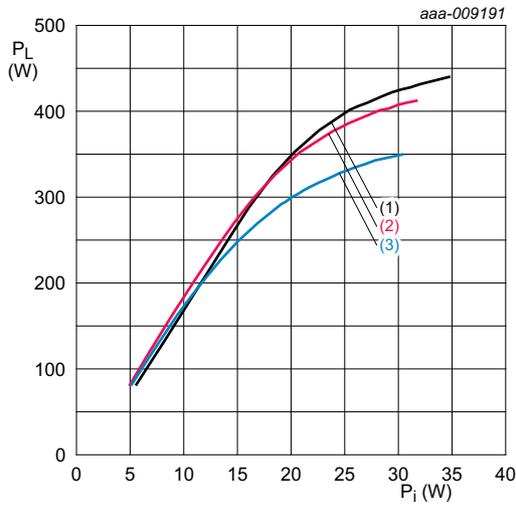
**Table 9. List of components**

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 μF, 50 V	TDK
C10, C12	multilayer ceramic chip capacitor	10 μF, 50 V	TDK
C13, C14	electrolytic capacitor	220 μF, 63 V	
R1, R2	SMD resistor	10 Ω	

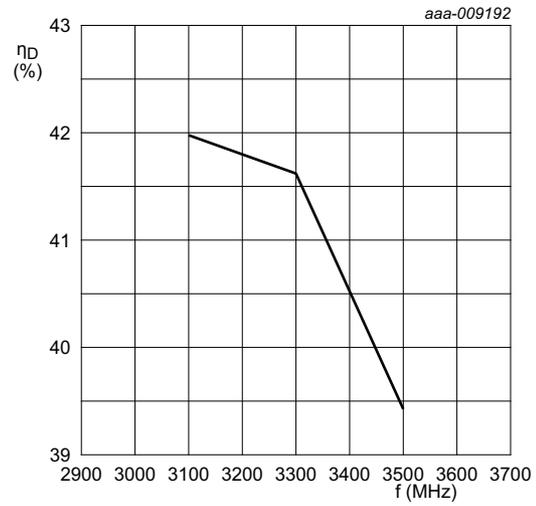
### 7.4 Graphical data





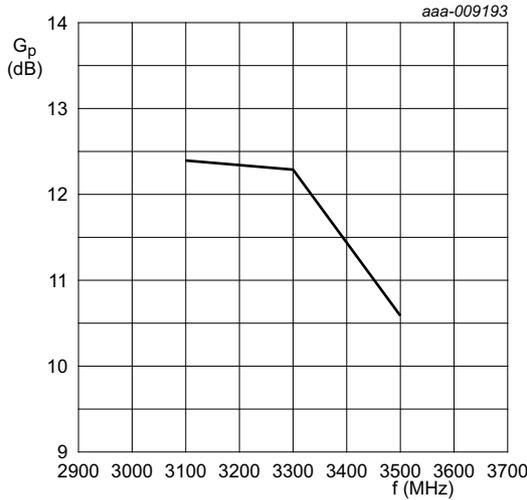
$V_{DS} = 32\text{ V}$ ;  $I_{Dq} = 200\text{ mA}$ ;  $t_p = 300\text{ }\mu\text{s}$ ;  $\delta = 10\text{ }\%$ .  
 (1)  $f = 3100\text{ MHz}$   
 (2)  $f = 3300\text{ MHz}$   
 (3)  $f = 3500\text{ MHz}$

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



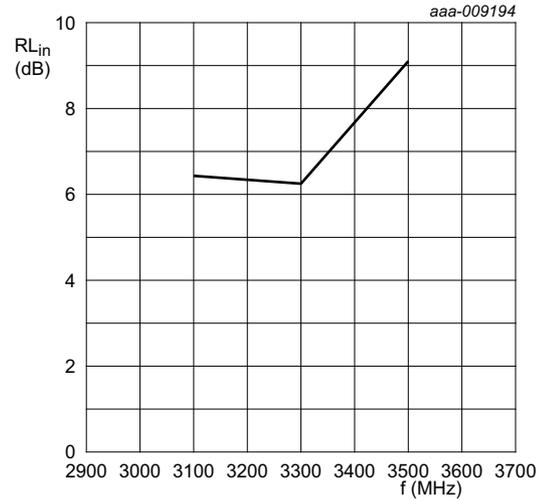
$V_{DS} = 32\text{ V}$ ;  $I_{Dq} = 200\text{ mA}$ ;  $t_p = 300\text{ }\mu\text{s}$ ;  $\delta = 10\text{ }\%$ ;  
 $P_L = 350\text{ W}$ .

**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

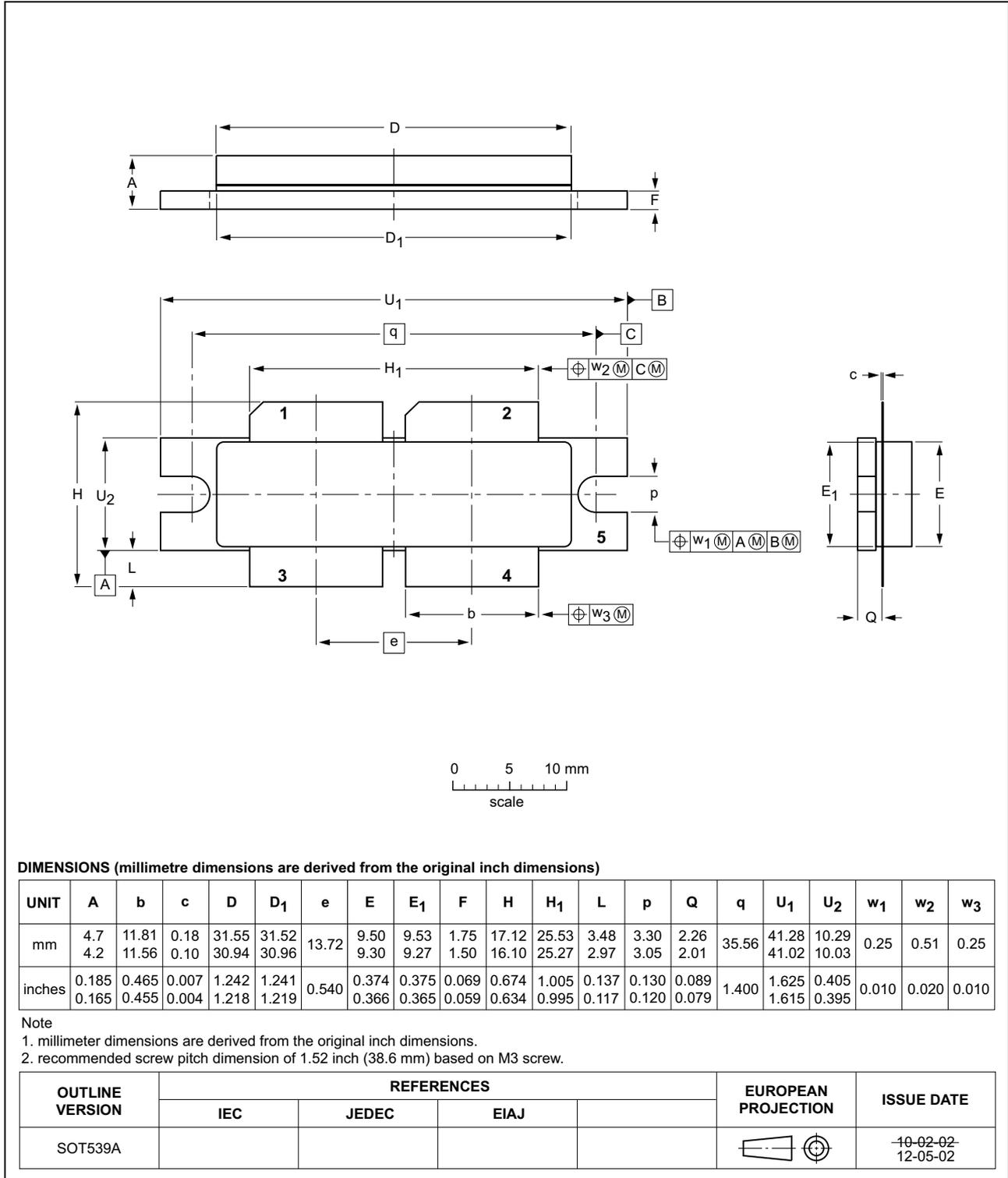


Fig 9. Package outline SOT539A

Earless flanged balanced ceramic package; 4 leads

SOT539B

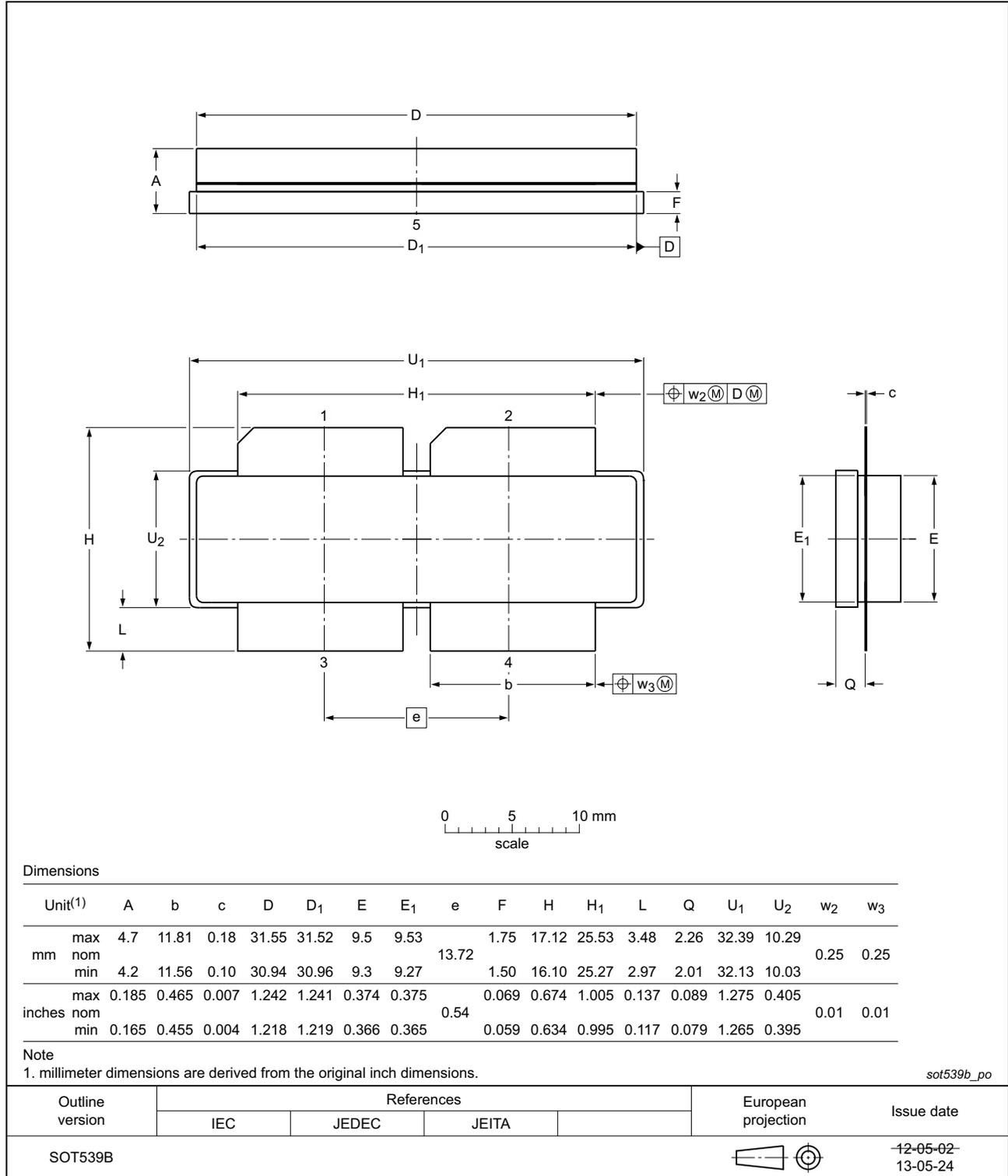


Fig 10. Package outline SOT539B

## 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#4	20150901	Product data sheet		BLS73135L-350P_7G3135LS-350P v.3
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>		
BLS73135L-350P_7G3135LS-350P v.3	20131029	Product data sheet	-	BLS73135L-350P_7G3135LS-350P v.2
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 <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
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Date of release: 1 September 2015

Document identifier: BLS7G3135L-350P\_7G3135LS-350P#4