

BLL6G1214L-250

LDMOS L-band radar power transistor

Rev. 1 — 16 February 2012

Preliminary data sheet

1. Product profile

1.1 General description

250 W LDMOS power transistor intended for L-band radar applications in the 1.2 GHz to 1.4 GHz range.

Table 1. Test information

Typical RF performance at $T_{case} = 25\text{ }^{\circ}\text{C}$; $t_p = 1\text{ ms}$; $\delta = 10\text{ }\%$; $I_{DQ} = 150\text{ mA}$; 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	1.2 to 1.4	36	250	15	45	15	5

1.2 Features and benefits

- Typical pulsed RF performance at a frequency of 1.2 GHz to 1.4 GHz, a supply voltage of 36 V, an I_{DQ} of 150 mA, a t_p of 1 ms with δ of 10 %:
 - ◆ Output power = 250 W
 - ◆ Power gain = 15 dB
 - ◆ Efficiency = 45 %
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (1.2 GHz to 1.4 GHz)
- Internally matched for ease of use
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

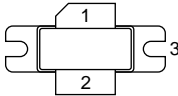
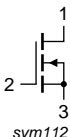
1.3 Applications

- L-band power amplifiers for radar applications in the 1.2 GHz to 1.4 GHz frequency range



2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain		
2	gate		
3	source		

[1] Connected to flange

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLL6G1214L-250	-	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		-	89	V
V_{GS}	gate-source voltage		-0.5	+11	V
I_D	drain current		-	59	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
$R_{th(j-case)}$	thermal resistance from junction to case	$T_{case} = 85\text{ }^{\circ}\text{C}$; $P_L = 250\text{ W}$	0.244	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	$T_{case} = 85\text{ }^{\circ}\text{C}$; $P_L = 250\text{ W}$	[1]	
		$t_p = 1000\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$	0.124	K/W
		$t_p = 100\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$	0.059	K/W
		$t_p = 200\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$	0.077	K/W
		$t_p = 300\text{ }\mu\text{s}$; $\delta = 10\text{ }\%$	0.088	K/W
		$t_p = 100\text{ }\mu\text{s}$; $\delta = 20\text{ }\%$	0.078	K/W

[1] $Z_{th(j-c)}$ values are calculated from results obtained with ANSYS simulations and confirmed with IR measurements during development stage. During production: guaranteed by design.

6. Characteristics

Table 6. DC Characteristics

$T_j = 25\text{ }^{\circ}\text{C}$

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}$; $I_D = 3.36\text{ mA}$	91.5	-	105.5	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 20\text{ V}$; $I_D = 336\text{ mA}$	1.4	1.9	2.4	V
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}$; $V_{DS} = 42\text{ V}$	-	-	4.2	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$; $V_{DS} = 10\text{ V}$	50	59	-	A
I_{GSS}	gate leakage current	$V_{GS} = 11\text{ V}$; $V_{DS} = 0\text{ V}$	-	-	420	nA
g_{fs}	forward transconductance	$V_{DS} = 10\text{ V}$; $I_D = 336\text{ mA}$	51.6	-	-	mS
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}$; $I_D = 11.7\text{ A}$	-	-	127	m Ω
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 40\text{ V}$; $f = 1\text{ MHz}$	-	285	-	pF
C_{oss}	output capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 40\text{ V}$; $f = 1\text{ MHz}$	-	90	-	pF
C_{rss}	reverse transfer capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 40\text{ V}$; $f = 1\text{ MHz}$	-	3	-	pF

Table 7. RF characteristics

Test signal: pulsed RF; $t_p = 1\text{ ms}$; $\delta = 10\text{ }\%$; RF performance at $V_{DS} = 36\text{ V}$; $I_{Dq} = 150\text{ mA}$;
 $T_{case} = 25\text{ }^{\circ}\text{C}$; unless otherwise specified, in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage		-	-	36	V
I_{Dq}	quiescent drain current	No RF applied	-	150	-	mA
P_L	output power		250	-	-	W
f_{range}	frequency range		1200	-	1400	MHz
t_p	pulse duration	$\delta = 10\text{ }\%$	-	-	1	ms
		$\delta = 20\text{ }\%$	-	-	100	μs

Table 7. RF characteristics ...continued

Test signal: pulsed RF; $t_p = 1\text{ ms}$; $\delta = 10\%$; RF performance at $V_{DS} = 36\text{ V}$; $I_{Dq} = 150\text{ mA}$; $T_{case} = 25\text{ }^\circ\text{C}$; unless otherwise specified, in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
η_D	drain efficiency		42	45	-	%
t_r	rise time	$P_L = 250\text{ W}$	[1]	-	200	ns
t_f	fall time	$P_L = 250\text{ W}$	[1]	-	200	ns
G_p	power gain		13	15	-	dB
$P_{\text{droop(pulse)}}$	pulse droop power		-	-	0.6	dB
RL_{in}	input return loss		-	-	-8	dB

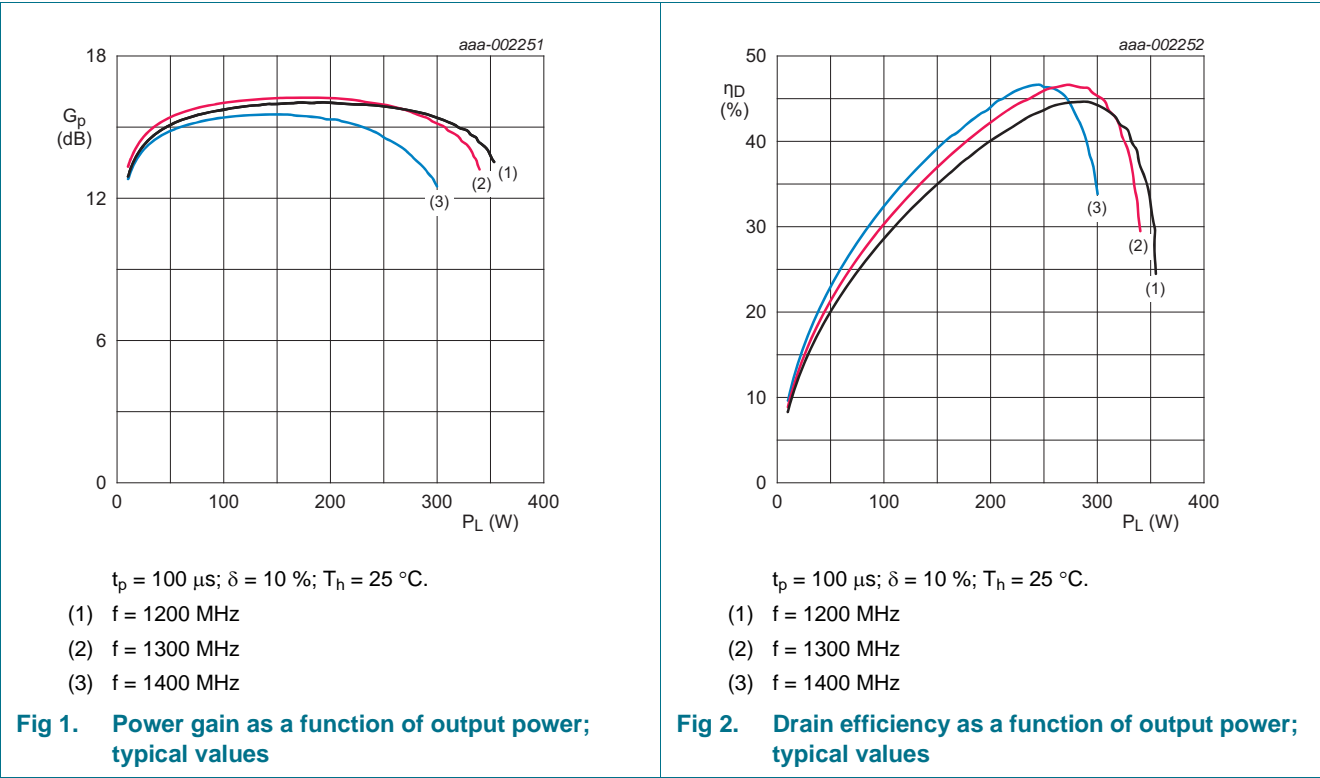
[1] The rise and fall time of the input circuit will be 5 ns maximum.

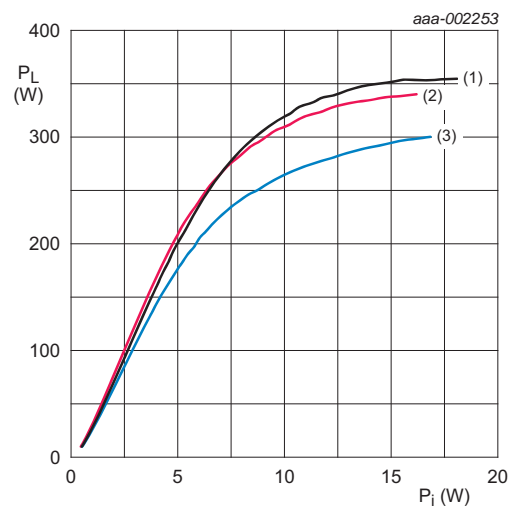
6.1 Ruggedness in class-AB operation

The BLL6G1214L-250 is capable of withstanding a load mismatch corresponding to $VSWR = 10 : 1$ through all phases under the following conditions: $V_{DS} = 36\text{ V}$; $I_{Dq} = 150\text{ mA}$; $P_L = 250\text{ W}$; $t_p = 1\text{ ms}$; $\delta = 10\%$.

7. Application information

7.1 Graphs

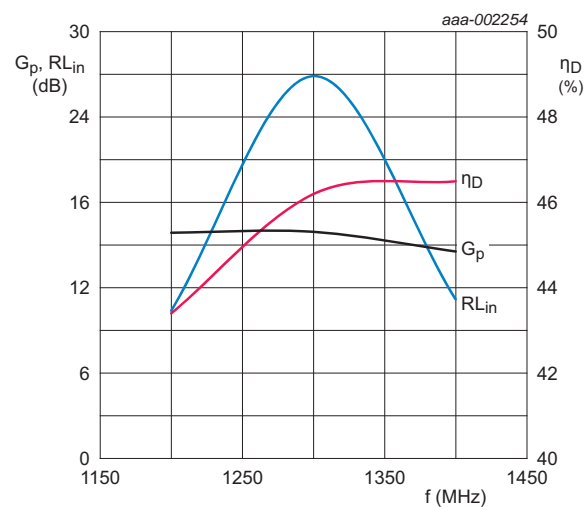




$t_p = 100 \mu\text{s}$; $\delta = 10 \%$; $T_h = 25^\circ\text{C}$.

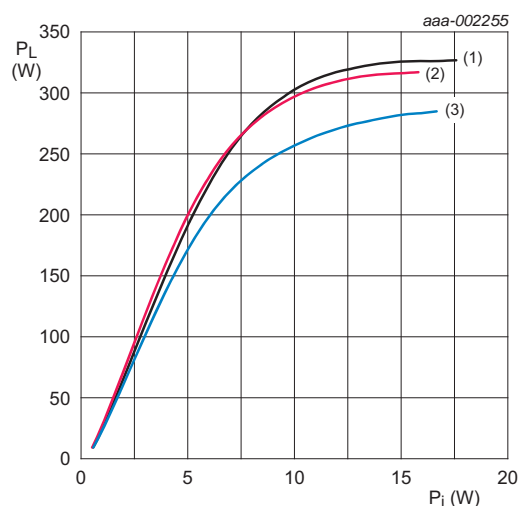
- (1) $f = 1200 \text{ MHz}$
- (2) $f = 1300 \text{ MHz}$
- (3) $f = 1400 \text{ MHz}$

Fig 3. Output power as a function of input power; typical values



$P_L = 250 \text{ W}$; $t_p = 100 \mu\text{s}$; $\delta = 10 \%$; $T_h = 25^\circ\text{C}$.

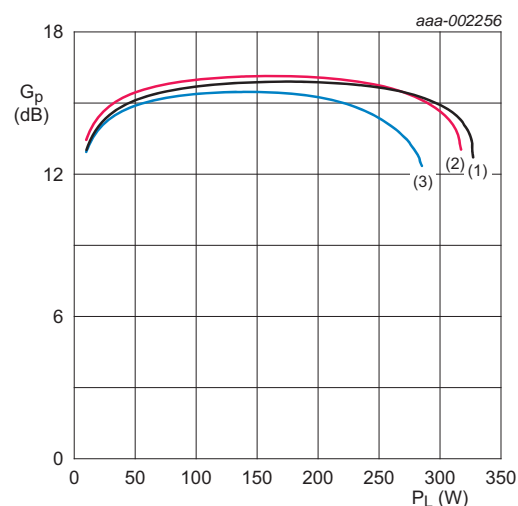
Fig 4. Power gain, input return loss and drain efficiency as function of frequency; typical values



$t_p = 1 \text{ ms}$; $\delta = 10 \%$; $T_h = 25^\circ\text{C}$.

- (1) $f = 1200 \text{ MHz}$
- (2) $f = 1300 \text{ MHz}$
- (3) $f = 1400 \text{ MHz}$

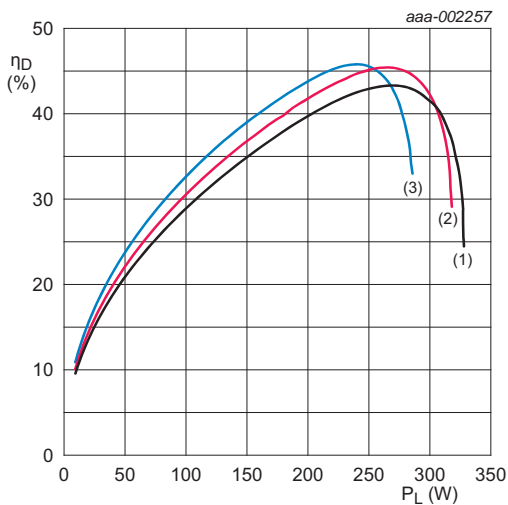
Fig 5. Output power as a function of input power; typical values



$t_p = 1 \text{ ms}$; $\delta = 10 \%$; $T_h = 25^\circ\text{C}$.

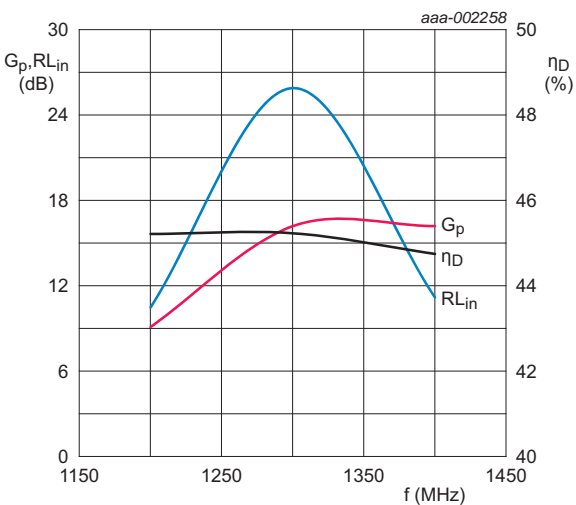
- (1) $f = 1200 \text{ MHz}$
- (2) $f = 1300 \text{ MHz}$
- (3) $f = 1400 \text{ MHz}$

Fig 6. Power gain as a function of output power; typical values



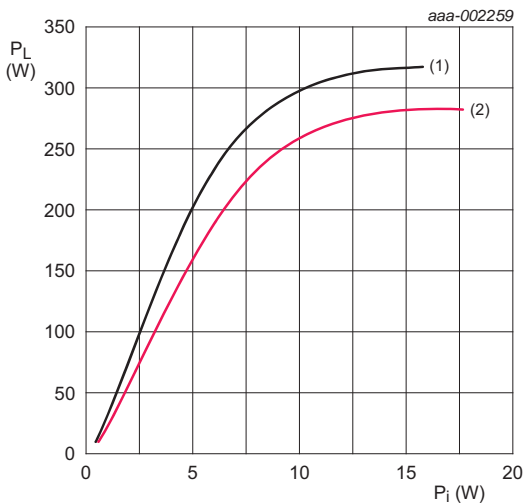
$t_p = 1 \text{ ms}$; $\delta = 10 \%$; $T_h = 25 \text{ }^\circ\text{C}$.
(1) $f = 1200 \text{ MHz}$
(2) $f = 1300 \text{ MHz}$
(3) $f = 1400 \text{ MHz}$

Fig 7. Drain efficiency as a function of output power; typical values



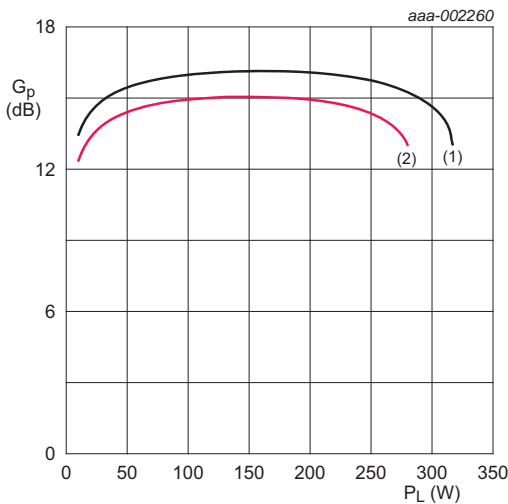
$P_L = 250 \text{ W}$; $t_p = 1 \text{ ms}$; $\delta = 10 \%$; $T_h = 25 \text{ }^\circ\text{C}$.

Fig 8. Power gain, input return loss and drain efficiency as function of frequency; typical values



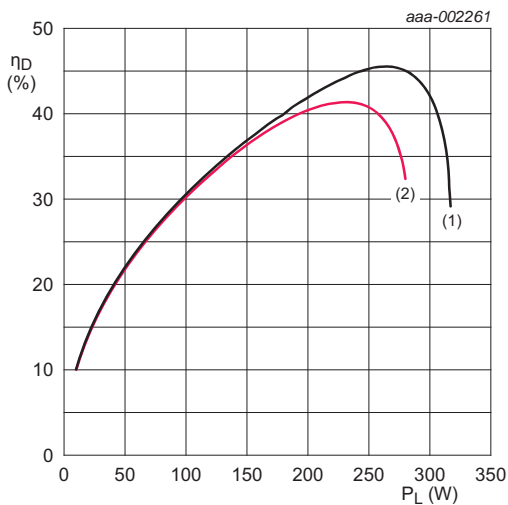
$f = 1300 \text{ MHz}$; $t_p = 1 \text{ ms}$; $\delta = 10 \%$.
(1) $T_h = 25 \text{ }^\circ\text{C}$
(2) $T_h = 85 \text{ }^\circ\text{C}$

Fig 9. Output power as a function of input power; typical values



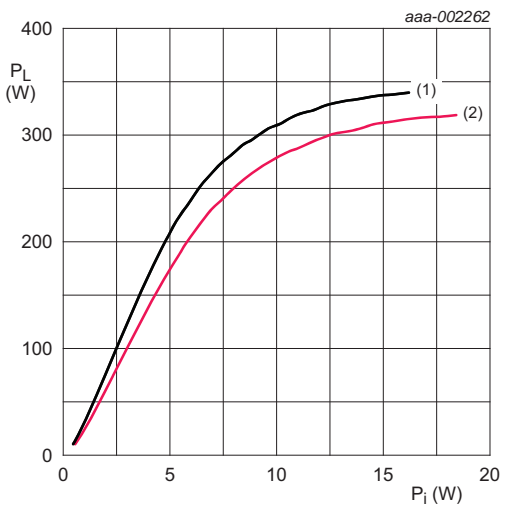
$f = 1300 \text{ MHz}$; $t_p = 1 \text{ ms}$; $\delta = 10 \%$.
(1) $T_h = 25 \text{ }^\circ\text{C}$
(2) $T_h = 85 \text{ }^\circ\text{C}$

Fig 10. Power gain as a function of output power; typical values



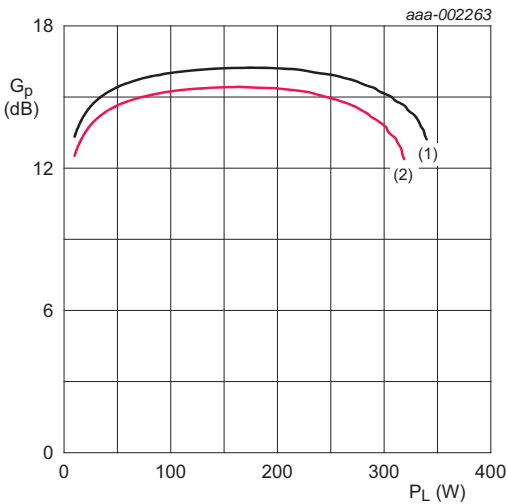
$f = 1300\text{ MHz}$; $t_p = 1\text{ ms}$; $\delta = 10\%$.
(1) $T_h = 25^\circ\text{C}$
(2) $T_h = 85^\circ\text{C}$

Fig 11. Drain efficiency as a function of output power; typical values



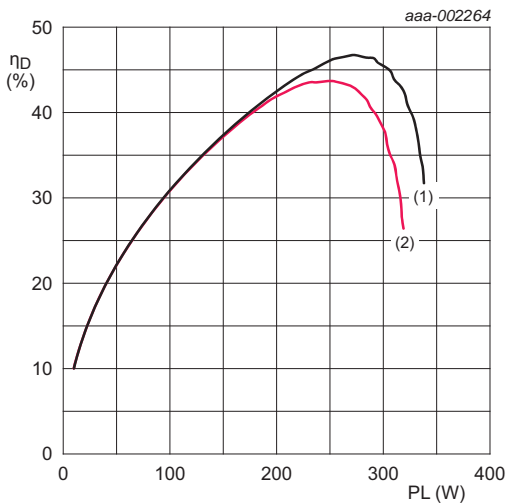
$f = 1300\text{ MHz}$; $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\%$.
(1) $T_h = 25^\circ\text{C}$
(2) $T_h = 85^\circ\text{C}$

Fig 12. Output power as a function of input power; typical values



$f = 1300\text{ MHz}$; $t_p = 1\text{ ms}$; $\delta = 10\%$.
(1) $T_h = 25^\circ\text{C}$
(2) $T_h = 85^\circ\text{C}$

Fig 13. Power gain as a function of output power; typical values



$f = 1300\text{ MHz}$; $t_p = 100\text{ }\mu\text{s}$; $\delta = 10\%$.
(1) $T_h = 25^\circ\text{C}$
(2) $T_h = 85^\circ\text{C}$

Fig 14. Drain efficiency as a function of output power; typical values

7.2 Impedance information

Table 8. Typical impedance
Typical values unless otherwise specified.

f GHz	Z _S Ω	Z _L Ω
1.2	1.077 – j2.78	1.288 – j1.014
1.3	1.352 – j2.949	1.139 – j1.086
1.4	1.881 – j2.640	1.038 – j1.132

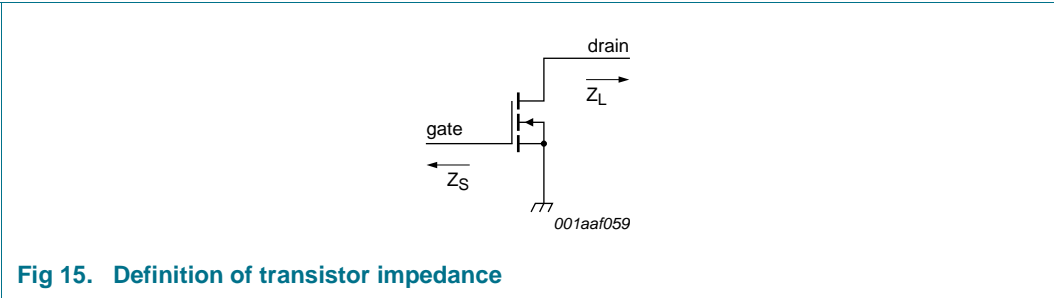


Fig 15. Definition of transistor impedance

7.3 Circuit information

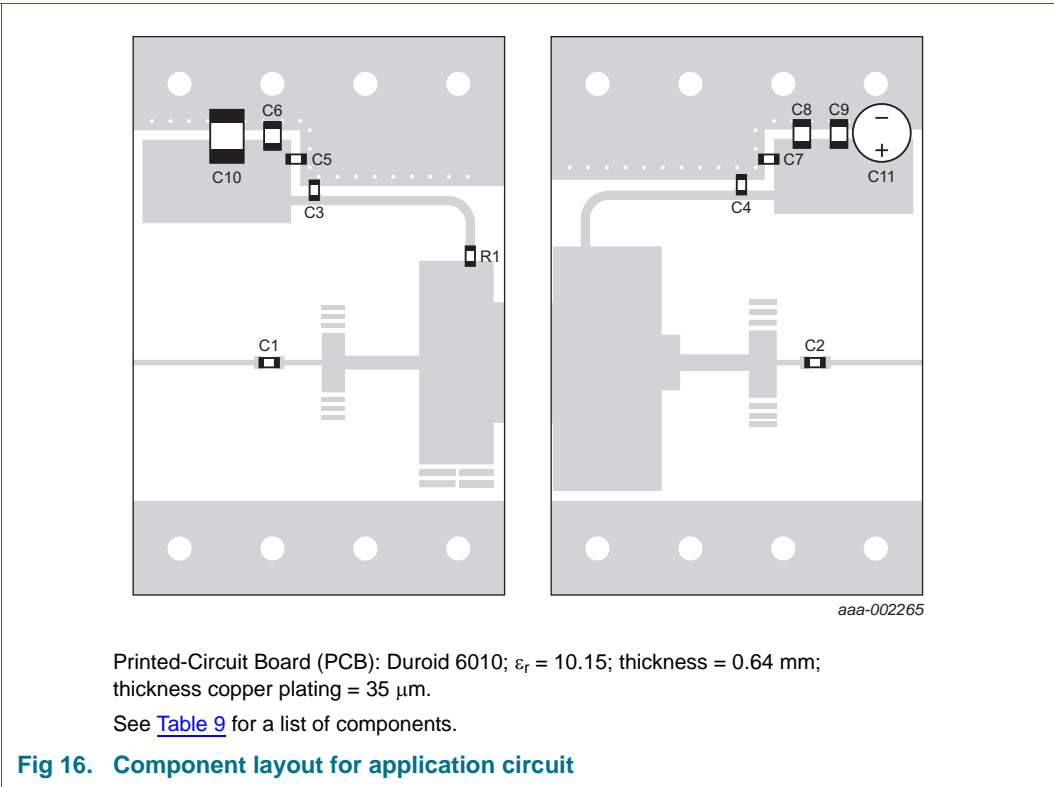


Fig 16. Component layout for application circuit

Table 9. List of components*For test circuit see [Figure 16](#).*

Component	Description	Value	Remarks
C1, C2, C3, C4, C7	multilayer ceramic chip capacitor	56 pF	[1]
C5, C8	multilayer ceramic chip capacitor	200 pF	[2]
C6, C9	multilayer ceramic chip capacitor	1 nF	[3]
C10	multilayer ceramic chip capacitor	10 μ F; 20 V	
C11	electrolytic capacitor	22 μ F; 63 V	
R1	SMD resistor	10 Ω	0603

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

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

[3] American Technical Ceramics type 700A or capacitor of same quality.

8. Package outline

Flanged LDMOST ceramic package; 2 mounting holes; 2 leads

SOT502A

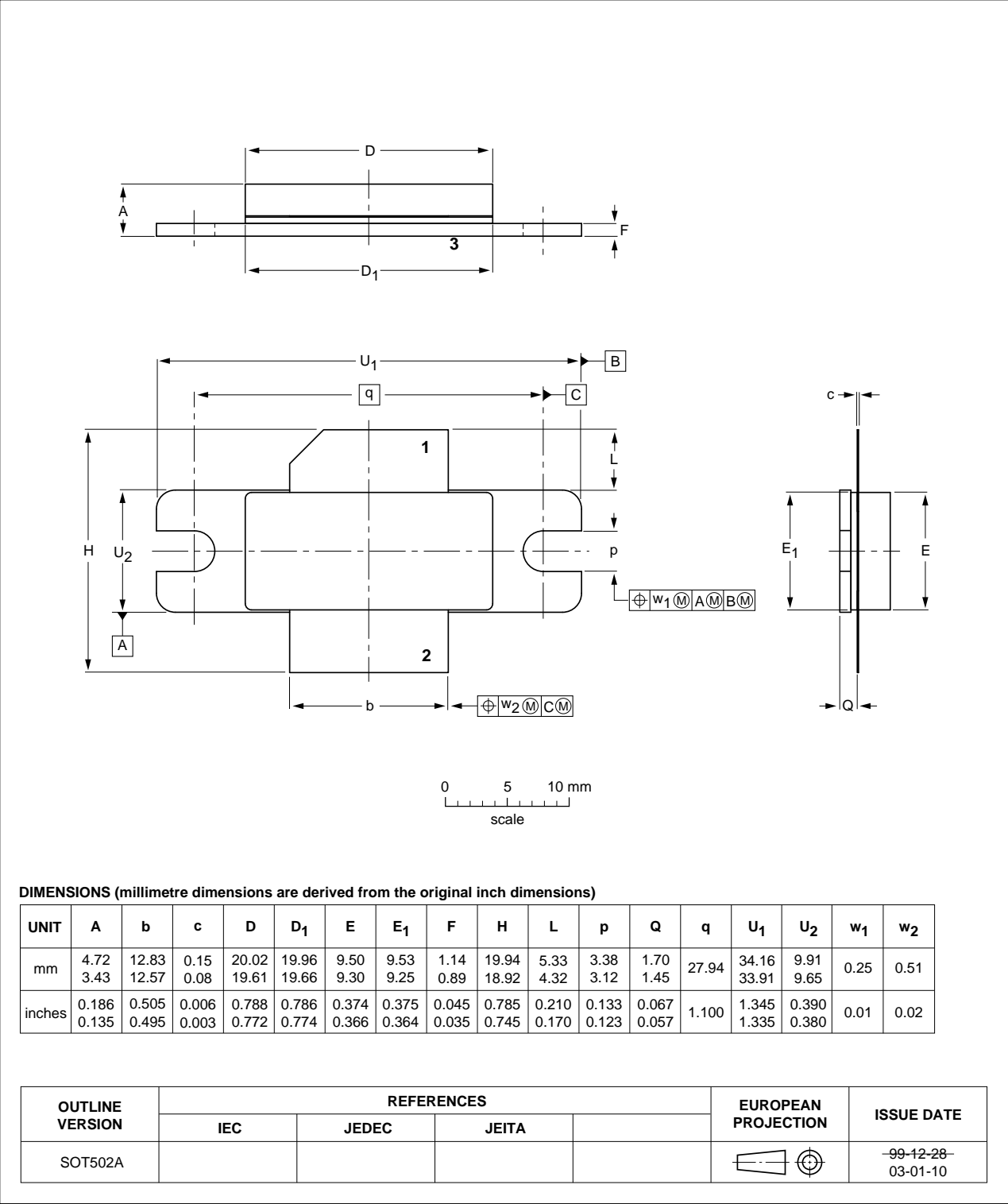


Fig 17. Package outline SOT502A

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
DC	Direct Current
ESD	ElectroStatic Discharge
IR	InfraRed
L-band	Long wave band
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
RF	Radio Frequency
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
BLL6G1214L-250 v.1	20120216	Preliminary data sheet	-	-

12. Legal information

12.1 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.

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

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