BLD6G21L-50; BLD6G21LS-50

TD-SCDMA 2010 MHz to 2025 MHz fully integrated Doherty transistor

AMPLEON

Rev. 3 — 1 September 2015 Product data sheet

1. Product profile

1.1 General description

The BLD6G21L-50 and BLD6G21LS-50 incorporate a fully integrated Doherty solution using Ampleon's state of the art GEN6 LDMOS technology. This device is perfectly suited for TD-SCDMA base station applications at frequencies from 2010 MHz to 2025 MHz. The main and peak device, input splitter and output combiner are integrated in a single package. This package consists of one gate and drain lead and two extra leads of which one is used for biasing the peak amplifier and the other is not connected. It only requires the proper input/output match and bias setting as with a normal class-AB transistor.

Table 1. Typical performance

RF performance at T_h = 25 °C.

Mode of operation	f	V_{DS}	$P_{L(AV)}$	G_p	η_D	ACPR	$P_{L(3dB)}$
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)	(W)
TD-SCDMA [1][2]	2010 to 2025	28	8	14.5	43	−24	53

[1] Test signal: 6-carrier TD-SCDMA; PAR = 10.8 dB at 0.01 % probability on CCDF.

[2] I_{Dq} = 170 mA (main); $V_{GS(amp)peak}$ = 0 V.

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features and benefits

- Typical TD-SCDMA performance at frequencies from 2010 MHz to 2025 MHz:
  - Average output power = 8 W
  - Power gain = 14.5 dB
  - Efficiency = 43 %
- Fully optimized integrated Doherty concept:
  - integrated asymmetrical power splitter at input
  - integrated power combiner
  - peak biasing down to 0 V
  - low junction temperature
  - high efficiency
- 100 % peak power tested for guaranteed output power capability

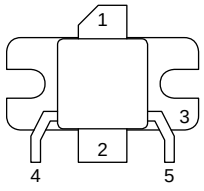
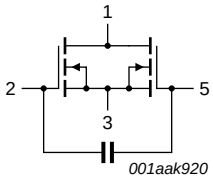
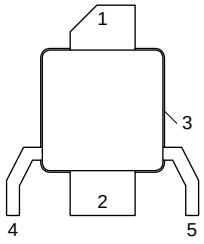
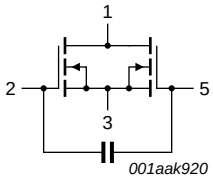
- Integrated ESD protection
- Good pair match (main and peak on the same chip)
- Independent control of main and peak bias
- Internally matched for ease of use
- Excellent ruggedness
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- High efficiency RF power amplifiers with digital pre-distortion for TD-SCDMA multi carrier applications in the 2010 MHz to 2025 MHz range.

2. Pinning information

Table 2. Pinning

Pin	Description		Simplified outline	Graphic symbol
BLD6G21L-50 (SOT1130A)				
1	drain			
2	gate + bias main			
3	source	[1]		
4	n.c.			
5	bias peak			
BLD6G21LS-50 (SOT1130B)				
1	drain			
2	gate + bias main			
3	source	[1]		
4	n.c.			
5	bias peak			

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLD6G21L-50	-	flanged ceramic package; 2 mounting holes; 4 leads	SOT1130A
BLD6G21LS-50	-	earless flanged ceramic package; 4 leads	SOT1130B

4. Block diagram

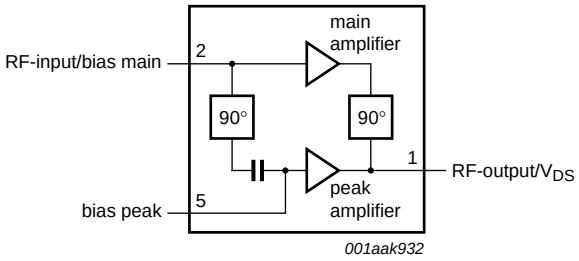


Fig 1. Block diagram of BLD6G21L-50 and BLD6G21LS-50

5. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).
Valid for both main and peak device.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage		-	65	V
$V_{GS(amp)main}$	main amplifier gate-source voltage		–0.5	+13	V
$V_{GS(amp)peak}$	peak amplifier gate-source voltage		–0.5	+13	V
I_D	drain current		-	10.2	A
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	200	°C

6. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j-case)}$	thermal resistance from junction to case	T_{case} = 80 °C; P_L = 8 W	[1]	2.1	K/W

[1] When operated with a 6-carrier TD-SCDMA modulated signal with PAR = 10.8 dB at 0.01 % probability on CCDF.

7. Characteristics

Table 6. Characteristics

Valid for both main and peak device.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.62 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 31 mA	1.4	1.8	2.4	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 170 mA	1.55	2.05	2.55	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	4.95	5.5	-	A

Table 6. Characteristics *...continued*
Valid for both main and peak device.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 1.55 A	1.4	2.2	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 1.085 A	-	0.52	0.736	Ω

8. Application information

Table 7. Application information
Mode of operation: 6-carrier TD-SCDMA; PAR 10.8 dB at 0.01 % probability on CCDF; f = 2017.5 MHz; RF performance at V_{DS} = 28 V; I_{Dq} = 170 mA; $V_{GS(amp)peak}$ = 0 V; T_{case} = 25 °C; unless otherwise specified; in a production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(AV)}$	average output power		-	8	-	W
G_p	power gain	$P_{L(AV)}$ = 8 W	13	14.5	-	dB
η_D	drain efficiency	$P_{L(AV)}$ = 8 W	39	43	-	%
PAR_O	output peak-to-average ratio	$P_{L(AV)}$ = 8 W	-	9.4	-	dB
RL_{in}	input return loss	$P_{L(AV)}$ = 8 W	8	23	-	dB
ACPR	adjacent channel power ratio	$P_{L(AV)}$ = 8 W	-	–24	–20	dBc

Table 8. Application information
Mode of operation: Pulsed CW; δ = 10 %; t_p = 100 μs; RF performance at V_{DS} = 28 V; I_{Dq} = 170 mA; $V_{GS(amp)peak}$ = 0 V; T_{case} = 25 °C; unless otherwise specified; in a production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{L(3dB)}$	output power at 3 dB gain compression		46	53	-	W

8.1 Ruggedness in Doherty operation

The BLD6G21L-50 and BLD6G21LS-50 are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 28 V; I_{Dq} = 170 mA; P_L = 8 W (TD-SCDMA); f = 2017.5 MHz.

8.2 Impedance information

Table 9. Typical impedance
Measured Load Pull data; typical values unless otherwise specified.

f	Z_S	Z_L
MHz	Ω	Ω
1995	3.5 – 12.3j	6.7 – 6.1j
2010	3.6 – 12.7j	6.7 – 6.1j
2017.5	3.6 – 12.7j	6.7 – 5.7j
2025	3.7 – 12.7j	6.4 – 5.2j
2040	4.0 – 12.9j	5.7 – 4.8j

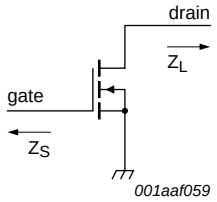
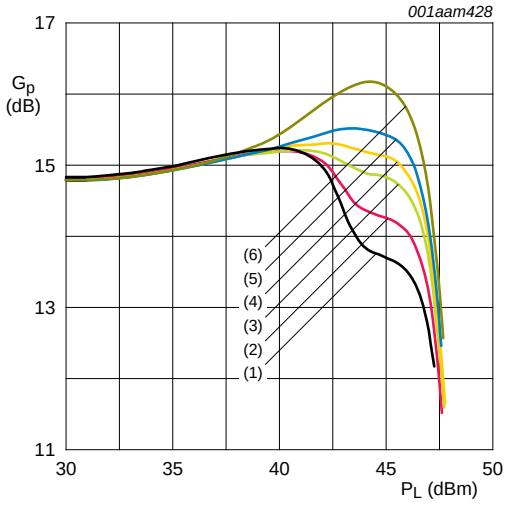


Fig 2. Definition of transistor impedance

8.3 Performance curves

Performance curves are measured in a BLD6G21L-50 application circuit.

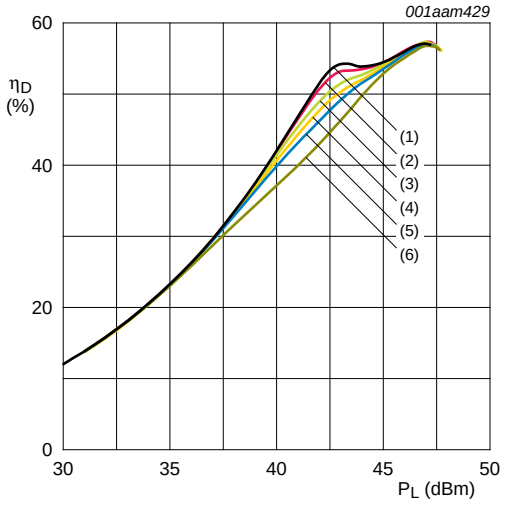
8.3.1 CW pulsed



V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C; f = 2017.5 MHz; δ = 10 %; t_p = 100 μs on 1 ms period.

(1) $V_{GS(amp)peak}$ = 0 V
(2) $V_{GS(amp)peak}$ = 0.2 V
(3) $V_{GS(amp)peak}$ = 0.4 V
(4) $V_{GS(amp)peak}$ = 0.5 V
(5) $V_{GS(amp)peak}$ = 0.6 V
(6) $V_{GS(amp)peak}$ = 0.8 V

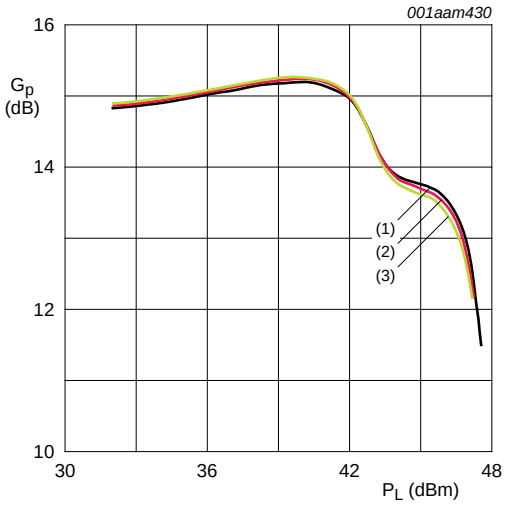
Fig 3. Power gain as a function of load power; typical values



V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C; f = 2017.5 MHz; δ = 10 %; t_p = 100 μs on 1 ms period.

(1) $V_{GS(amp)peak}$ = 0 V
(2) $V_{GS(amp)peak}$ = 0.2 V
(3) $V_{GS(amp)peak}$ = 0.4 V
(4) $V_{GS(amp)peak}$ = 0.5 V
(5) $V_{GS(amp)peak}$ = 0.6 V
(6) $V_{GS(amp)peak}$ = 0.8 V

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



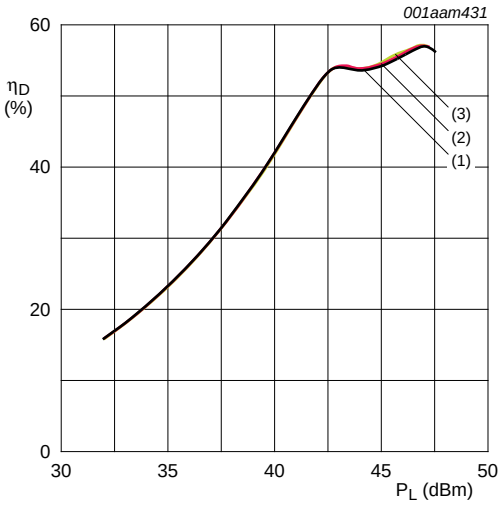
V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C;
$V_{GS(amp)peak}$ = 0 V; δ = 10 %; t_p = 100 μs on 1 ms period.

(1) f = 2010 MHz

(2) f = 2018 MHz

(3) f = 2025 MHz

Fig 5. Power gain as a function of load power; typical values



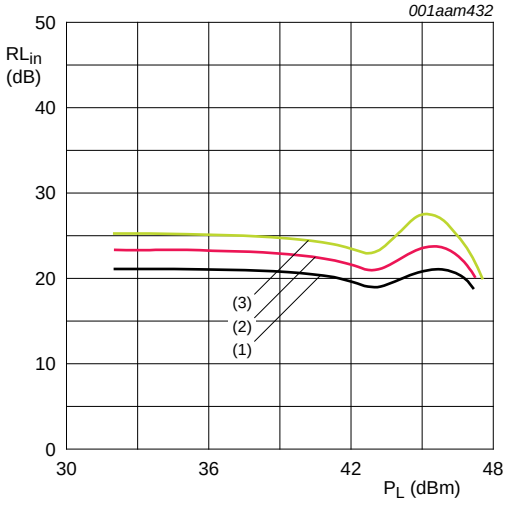
V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C;
$V_{GS(amp)peak}$ = 0 V; δ = 10 %; t_p = 100 μs on 1 ms period.

(1) f = 2010 MHz

(2) f = 2018 MHz

(3) f = 2025 MHz

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



V_{DS} = 28 V; I_{Dq} = 170 mA; $V_{GS(amp)peak}$ = 0 V; T_{case} = 25 °C; δ = 10 %; t_p = 100 μs on 1 ms period.

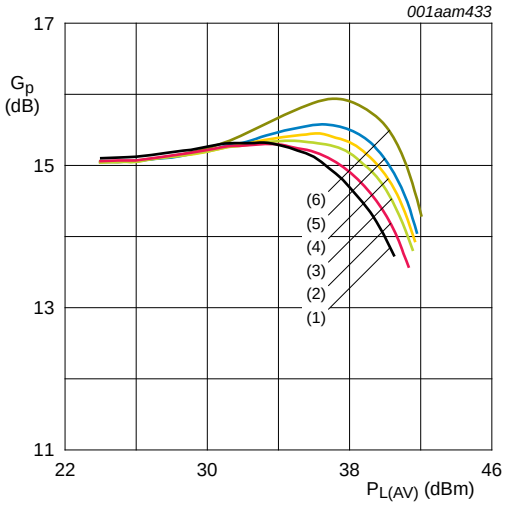
(1) f = 2010 MHz

(2) f = 2018 MHz

(3) f = 2025 MHz

Fig 7. Input return loss as a function of load power; typical values

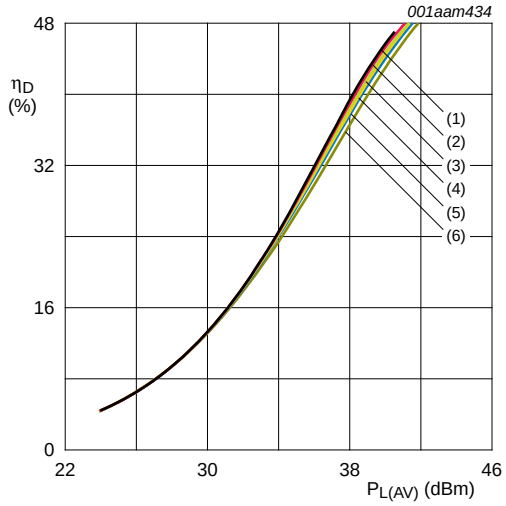
8.3.2 TD-SCDMA



V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C; f = 2017.5 MHz; 6-carrier TD-SCDMA; PAR = 10.8 dB at 0.01 % probability on CCDF.

(1) $V_{GS(amp)peak}$ = 0 V
(2) $V_{GS(amp)peak}$ = 0.2 V
(3) $V_{GS(amp)peak}$ = 0.4 V
(4) $V_{GS(amp)peak}$ = 0.5 V
(5) $V_{GS(amp)peak}$ = 0.6 V
(6) $V_{GS(amp)peak}$ = 0.8 V

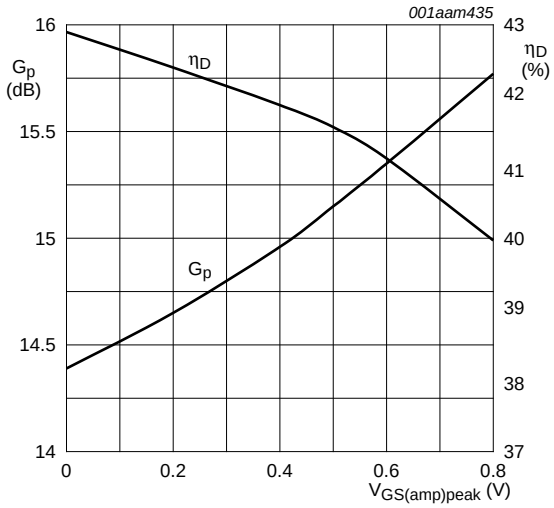
Fig 8. Power gain as a function of average load power; typical values



V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C; f = 2017.5 MHz; 6-carrier TD-SCDMA; PAR = 10.8 dB at 0.01 % probability on CCDF.

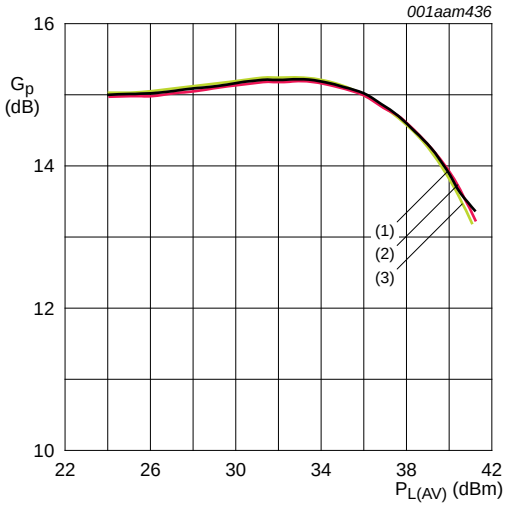
(1) $V_{GS(amp)peak}$ = 0 V
(2) $V_{GS(amp)peak}$ = 0.2 V
(3) $V_{GS(amp)peak}$ = 0.4 V
(4) $V_{GS(amp)peak}$ = 0.5 V
(5) $V_{GS(amp)peak}$ = 0.6 V
(6) $V_{GS(amp)peak}$ = 0.8 V

Fig 9. Drain efficiency as a function of average load power; typical values



V_{DS} = 28 V; I_{Dq} = 170 mA; $P_{L(AV)}$ = 8 W; T_{case} = 25 °C; f = 2017.5 MHz; 6-carrier TD-SCDMA; PAR = 10.8 dB at 0.01 % probability on CCDF.

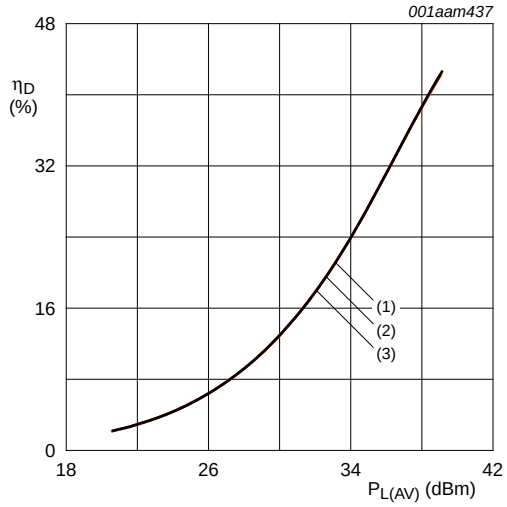
Fig 10. Power gain and drain efficiency as function of peak amplifier gate-source voltage; typical values



V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C; $V_{GS(amp)peak}$ = 0 V; 6-carrier TD-SCDMA; PAR = 10.8 dB at 0.01 % probability on CCDF.

(1) f = 2010 MHz
(2) f = 2018 MHz
(3) f = 2025 MHz

Fig 11. Power gain as a function of average load power; typical values

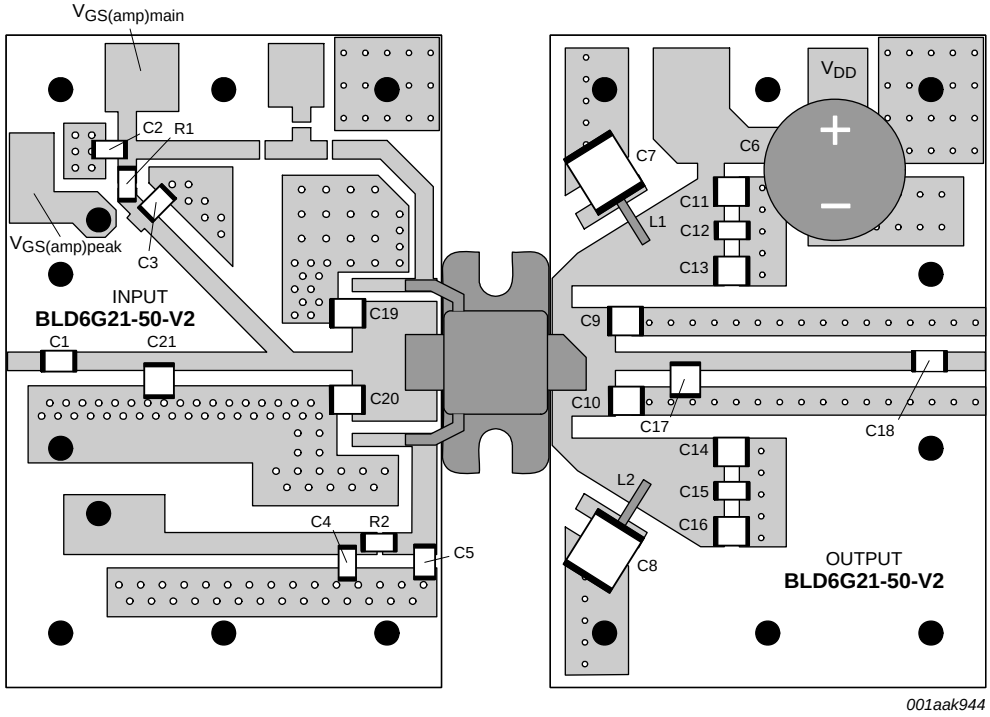


V_{DS} = 28 V; I_{Dq} = 170 mA (main); T_{case} = 25 °C; $V_{GS(amp)peak}$ = 0 V; 6-carrier TD-SCDMA; PAR = 10.8 dB at 0.01 % probability on CCDF.

(1) f = 2010 MHz
(2) f = 2018 MHz
(3) f = 2025 MHz

Fig 12. Drain efficiency as a function of average load power; typical values

9. Test information



The striplines are on a double copper-clad gold plated Rogers 4350B Printed-Circuit Board (PCB) with ε_r = 3.5 and thickness = 0.76 mm.

See Table 10 for list of components.

Fig 13. Component layout

Table 10. List of components

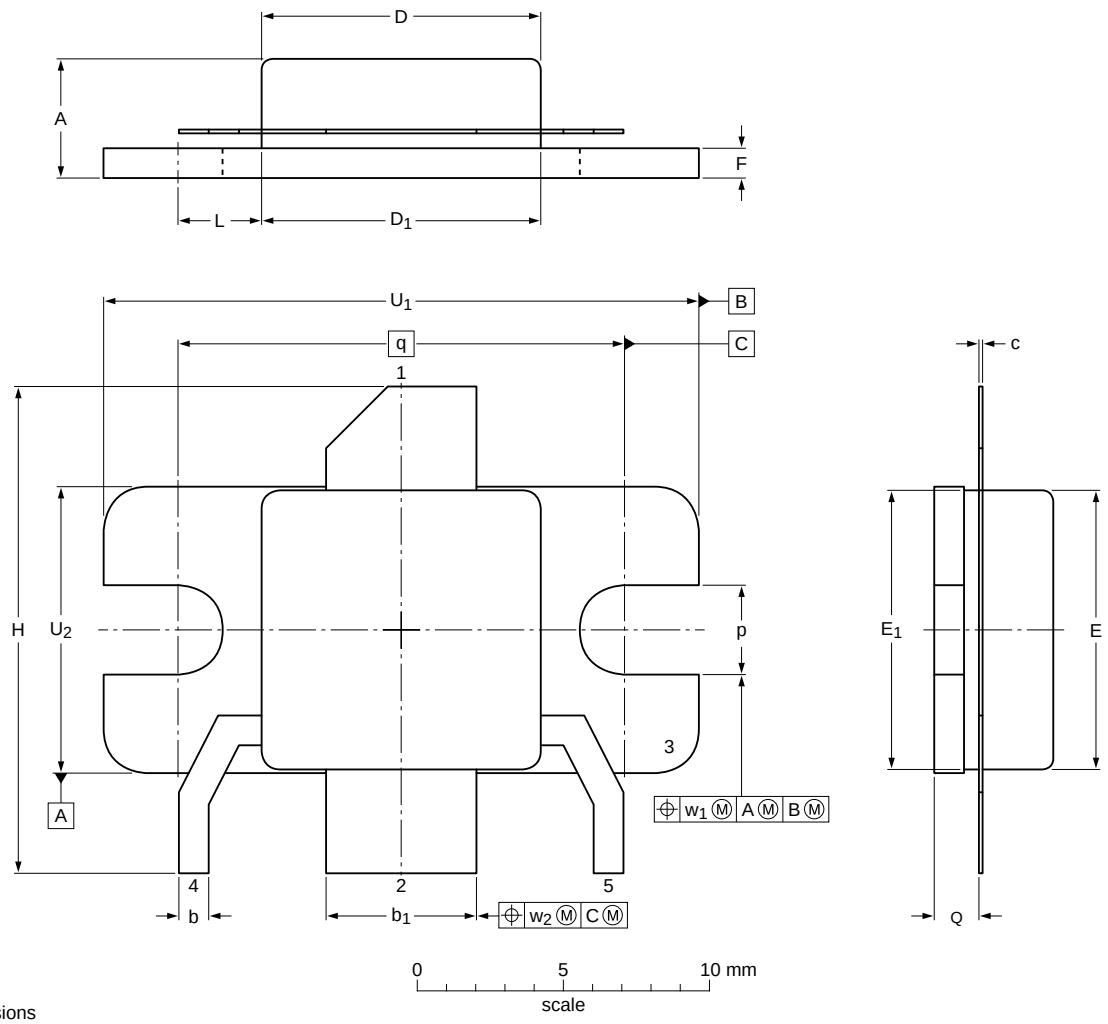
See Figure 13 for component layout.

Component	Description	Value		Dimensions
C1, C3, C5, C18	multilayer ceramic chip capacitor	9.1 pF	[1]	
C2, C4, C12, C15	multilayer ceramic chip capacitor	100 nF		
C6	electrolytic capacitor	470 μF; 63 V		
C7, C8	multilayer ceramic chip capacitor	10 μF		
C9, C10	multilayer ceramic chip capacitor	1.5 pF	[1]	
C11, C13, C14, C16	multilayer ceramic chip capacitor	8.2 pF	[1]	
C17	multilayer ceramic chip capacitor	1.2 pF	[1]	
C19, C20	multilayer ceramic chip capacitor	0.7 pF	[1]	
C21	multilayer ceramic chip capacitor	1.2 pF	[1]	
L1, L2	copper wire	-		diameter = 0.8 mm; length = 8 mm
R1	SMD resistor	3.6 Ω		1206
R2	SMD resistor	33 Ω		1206

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

10. Package outline

Flanged ceramic package; 2 mounting holes; 4 leads **SOT1130A**



Dimensions

Unit[1]		A	b	b_1	c	D	D_1	E	E_1	F	H	L	p	Q[2]	q	U_1	U_2	w_1	w_2
mm	max	4.65	1.14	5.26	0.18	9.65	9.65	9.65	9.65	1.14	17.12	3.00	3.30	1.70		20.45	9.91		
	nom														15.24			0.25	0.51
	min	3.76	0.89	5.00	0.10	9.40	9.40	9.40	9.40	0.89	16.10	2.69	2.92	1.45		20.19	9.65		
inches	max	0.183	0.045	0.207	0.007	0.38	0.38	0.38	0.38	0.045	0.674	0.118	0.130	0.067		0.805	0.39		
	nom														0.6			0.01	0.02
	min	0.148	0.035	0.197	0.004	0.37	0.37	0.37	0.37	0.035	0.634	0.106	0.115	0.057		0.795	0.38		

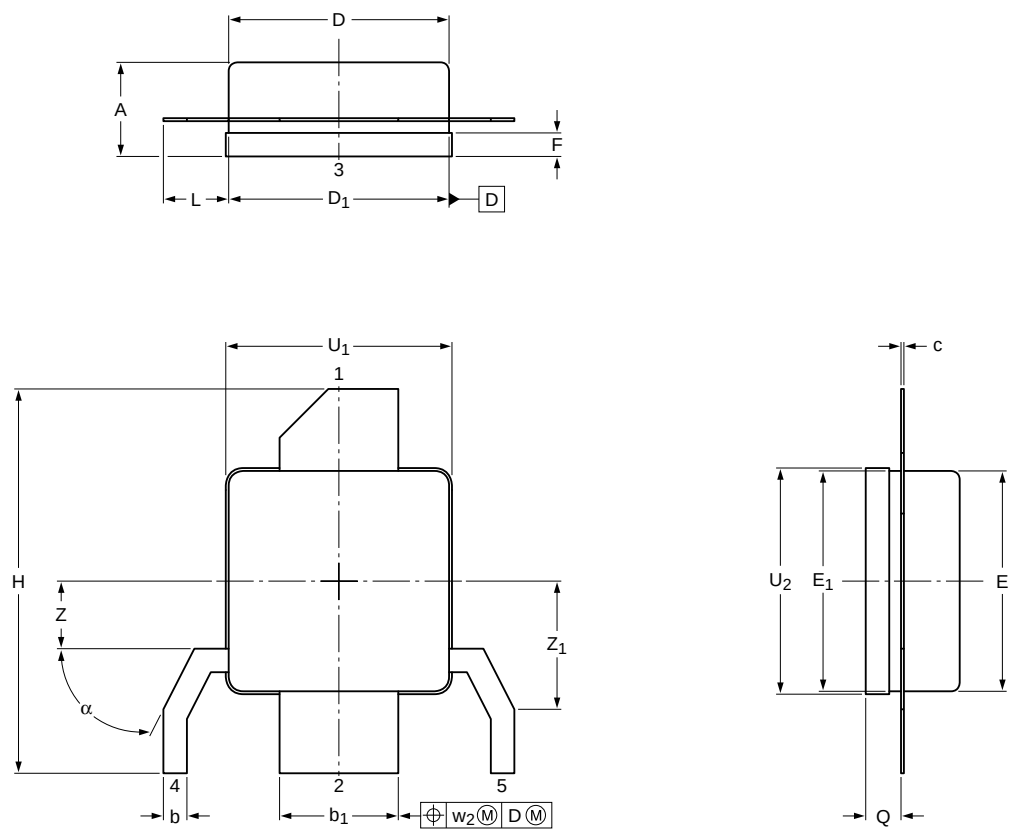
Note
1. millimeter dimensions are derived from the original inch dimensions.
2. dimension is measured 0.030 inch (0.76 mm) from the body.

sot1130a_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1130A						~~09-10-12~~ 10-02-02

Fig 14. Package outline SOT1130A

Earless flanged ceramic package; 4 leads **SOT1130B**



Dimensions

Unit[1]		A	b	b_1	c	D	D_1	E	E_1	F	H	L	Q	U_1	U_2	w_2	Z	Z_1	α
mm	max	4.65	1.14	5.26	0.18	9.65	9.65	9.65	9.65	1.14	17.12	3.00	1.70	9.91	9.91		3.05	5.66	64°
	nom															0.51			
	min	3.76	0.89	5.00	0.10	9.40	9.40	9.40	9.40	0.89	16.10	2.69	1.45	9.65	9.65		2.79	5.41	62°
inches	max	0.183	0.045	0.207	0.007	0.38	0.38	0.38	0.38	0.045	0.674	0.118	0.069	0.39	0.39		0.120	0.223	64°
	nom															0.02			
	min	0.148	0.035	0.197	0.004	0.37	0.37	0.37	0.37	0.035	0.634	0.106	0.059	0.38	0.38		0.110	0.213	62°

Note
1. millimeter dimensions are derived from the original inch dimensions.
2. dimension is measured 0.030 inch (0.76 mm) from the body.

sot1130b_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1130B						~~09-10-12~~ 09-12-14

Fig 15. Package outline SOT1130B

11. Abbreviations

Table 11. Abbreviations

Acronym	Description
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
PAR	Peak-to-Average power Ratio
RF	Radio Frequency
SMD	Surface Mounted Device
TD-SCDMA	Time Division-Synchronous Code Division Multiple Access
VSWR	Voltage Standing-Wave Ratio

12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLD6G21L-50_BLD6G21LS-50#3	20150901	Product data sheet	-	BLD6G21L-50_BLD6G21LS-50 v.2
Modifications:	• The format of this document has been redesigned to comply with the new identity guidelines of Ampleon. • Legal texts have been adapted to the new company name where appropriate.			
BLD6G21L-50_BLD6G21LS-50v.2	20100817	Product data sheet	-	BLD6G21L-50_BLD6G21LS-50 v.1
BLD6G21L-50_BLD6G21LS-50v.1	20091028	Objective data sheet	-	-

13. Legal information

13.1 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.ampleon.com.

13.2 Definitions

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14. Contact information

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For sales office addresses, please visit:
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Date of release: 1 September 2015
Document identifier: BLD6G21L-50_BLD6G21LS-50#3