CLF24H4LS300P

RF power GaN-SiC HEMT

Rev. 1 — 30 July 2024

AMPLEON

Product data sheet

1. Product profile

1.1 General description

300 W GaN-SiC HEMT power transistor optimized with best continuous wave (CW) power and efficiency for applications in cooking, industrial, scientific and medical at frequencies from 2400 MHz to 2500 MHz.

The CLF24H4LS300P is designed for high-power CW applications and is assembled in a high performance ceramic package.

Table 1. Application performance

RF performance at V_{DS} = 50 V; V_{GS} = −5 V; T_{amb} = 25 °C in a class-AB/class-C application circuit.

Test signal	f	V_{DS}	$P_{L(AV)}$	G_p	η_D
	(MHz)	(V)	(W)	(dB)	(%)
CW	2400 to 2500	50	320	14	74
CW pulsed [1]	2400 to 2500	50	350	14	75

[1] t_p = 100 µs; δ = 10 %

1.2 Features and benefits

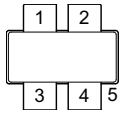
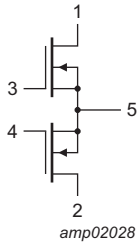
- High efficiency
- Excellent ruggedness under CW and CW pulsed conditions
- Designed for broadband operation (2400 MHz to 2500 MHz)
- Internally input matched
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- RF power amplifiers for CW applications in the 2400 MHz to 2500 MHz frequency range such as commercial and consumer cooking, industrial, scientific and medical applications

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain1		
2	drain2		
3	gate1		
4	gate2		
5	source [1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Package name	Orderable part number	12NC	Packing description	Min. orderable quantity (pieces)
SOT1214B	CLF24H4LS300PU	9349 607 62112	Tray; 20-fold; non-dry pack	60
	CLF24H4LS300PJ	9349 607 62118	TR13; 100-fold; 44 mm; non-dry pack	100

4. Limiting values

Table 4. Limiting values

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DD}	source voltage	operating	-	52	V
V_{DS}	drain-source voltage		-	150	V
V_{GS}	gate-source voltage		−15	+2	V
I_{GF}	forward gate current		-	43.2	mA
T_{stg}	storage temperature		−65	+150	°C
T_{ch}	active die channel temperature		-	225	°C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(s-c)(IR)}$ [1]	thermal resistance from active die surface to case by Infrared measurement	DC; V_{DS} = 50 V; I_D = 2.6 A; P_{dis} = 130 W; T_{case} = 50 °C	0.40	K/W
$R_{th(ch-c)(FEA)}$ [2]	thermal resistance from active die channel to case by Finite Element Analysis	P_{dis} = 134 W; T_{case} = 72 °C	0.58	K/W

[1] Infrared (IR) thermal values are for reference only and cannot be used to determine performance or reliability.

[2] Finite Element Analysis (FEA) thermal values have been used for the online MTF calculator.

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6. Characteristics

Table 6. DC characteristics

T_{amb} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 31.2 mA	–3.12	–2.72	–2.32	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 50 V; I_D = 624 mA	–3	–2.63	–2.2	V
$I_{D(leak)}$	drain leakage current	V_{DS} = 50 V; V_{GS} = –10 V	-	-	7.55	mA
I_{GSS}	gate leakage current	V_{DS} = 0 V; V_{GS} = –8 V	-	-	1.51	mA
I_{DSX}	drain cut-off current	V_{DS} = 20 V; V_{GS} = 2 V	-	22.4	-	A

Table 7. RF characteristics

Test signal: pulsed at 2450 MHz; RF performance at V_{DS} = 50 V; V_{GS} = –4 V; t_p = 200 μs; δ = 10 %; T_{amb} = 25 °C; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	P_L = 350 W	-	15	-	dB
RL_{in}	input return loss	P_L = 350 W	-	–10	-	dB
η_D	drain efficiency	P_L = 350 W	-	70	-	%

Table 8. Ruggedness performance

RF performance at T_{amb} = 25 °C; V_{GS} = –5 V; in a class-C demo.

Test signal	f	P_L	VSWR	V_{DS}	Result
	(MHz)	(W)		(V)	
CW	2450	320	20 : 1 at all phase angles	50	no device degradation
pulsed CW [1]	2450	450	20 : 1 at all phase angles	70	no device degradation

[1] t_p = 100 μs; δ = 20 %.

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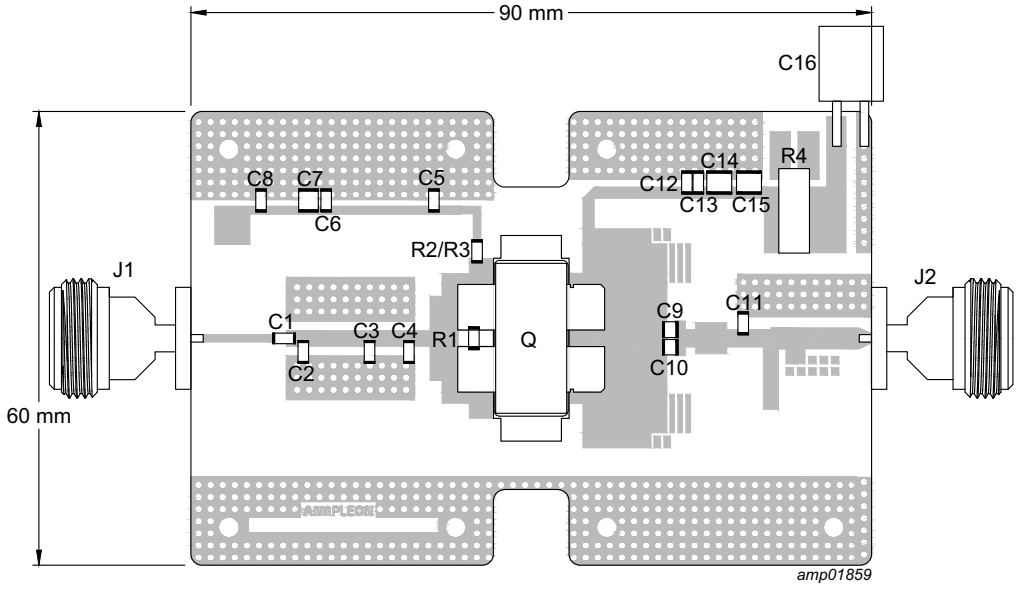
7. Application information

7.1 Test circuit



Printed-Circuit Board (PCB): Rogers TC350; ε_r = 3.5; thickness = 0.508 mm; thickness copper plating = 35 μm.
See Table 9 for a list of components.

Fig 1. Component layout

Table 9. List of components
See Figure 1.

Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	33 pF ± 5 %	ATC: ATC600F330JW250XT
C2	multilayer ceramic chip capacitor	1.0 pF ± 0.1 pF	ATC: ATC600F1R0BW250XT
C3	multilayer ceramic chip capacitor	0.8 pF ± 0.1 pF	ATC: ATC600F0R8BW250XT
C4, C11	multilayer ceramic chip capacitor	0.2 pF ± 0.1 pF	ATC: ATC600F0R2BW250XT
C5	multilayer ceramic chip capacitor	8.2 pF ± 5 %	ATC: ATC600F8R2JW250XT
C6, C13	multilayer ceramic chip capacitor	100 pF ± 5 %	ATC: ATC600F101JW250XT
C7, C14	multilayer ceramic chip capacitor	1000 pF ± 5 %	ATC: ATC100B102JW50XT
C8, C15	multilayer ceramic chip capacitor	10 μF ± 10 %	TDK: C3225X7R2A106K
C9	multilayer ceramic chip capacitor	1 pF ± 0.1 pF	ATC: ATC800R1R0BW500T
C10	multilayer ceramic chip capacitor	1.2 pF ± 0.1 pF	ATC: ATC800R1R2BW500T
C12	multilayer ceramic chip capacitor	100 pF ± 5 %	ATC: ATC600F102JW250XT
C16	electrolytic capacitor	1000 μF, 63 V ± 20 %	Panasonic
R1	resistor	5.1 Ω ± 5 %	
R2, R3	resistor	10 Ω ± 5 %	

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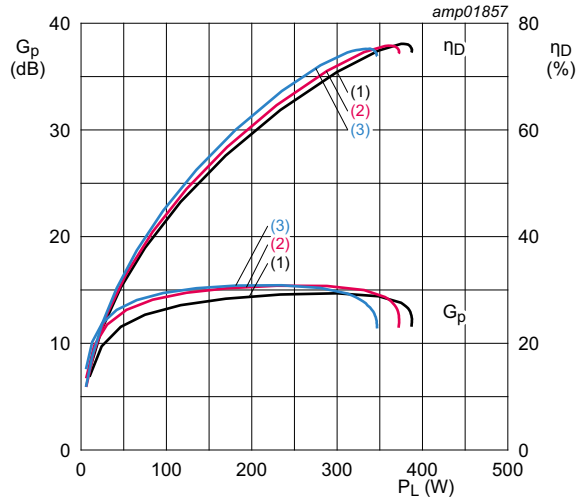
Table 9. List of components *...continued*

See Figure 1.

Component	Description	Value	Remarks
R4	resistor	0.0.1 Ω ± 1 %	Farnell: 2363984
J1, J2	connector		HUBER+SUHNER: 23_N-500-16/133_NE
Q1	GaN-SiC transistor		CLF24H4LS300P

7.2 Graphical data



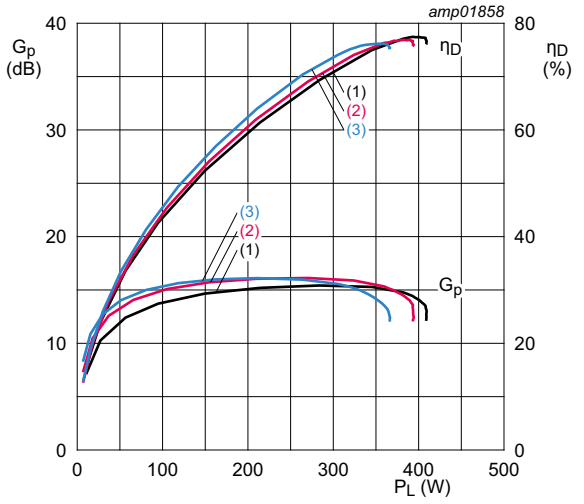
Test signal: CW; V_{DS} = 50 V; V_{GS} = –5 V.

(1) f = 2400 MHz

(2) f = 2450 MHz

(3) f = 2500 MHz

Fig 2. Power gain and drain efficiency as function of output power; typical values



Test signal: CW pulsed; V_{DS} = 50 V; V_{GS} = –5 V; t_p = 100 μs; δ = 10 %.

(1) f = 2400 MHz

(2) f = 2450 MHz

(3) f = 2500 MHz

Fig 3. Power gain and drain efficiency as function of output power; typical values

7.3 Impedance information

Table 10. Simulated test circuit impedances

f	Z_i	Z_L	$Z_{L(2H)}$
(MHz)	(Ω)	(Ω)	(Ω)
2400	3.82 – 8.04j	0.79 + 0.13j	1.95 + 8.64j
2450	3.29 – 7.75j	0.77 + 0.14j	2.95 + 10.73j
2500	2.85 – 7.43j	0.71 + 0.18j	5.10 + 13.63j

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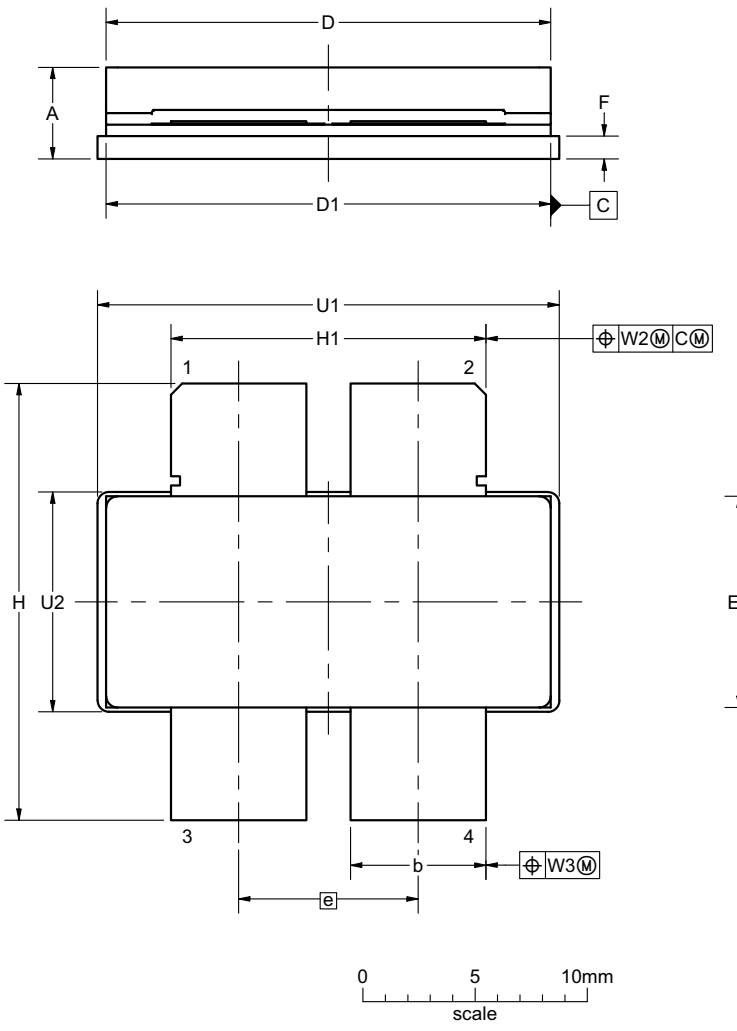
8. Package outline

Earless flanged ceramic package; 4 leads SOT1214B



Dimensions

Unit (1)		A	b	c	D	D1	e	E	E1	F	H	H1	Q(2)	U1	U2	w2	w3
mm	max	4.72	6.17	0.15	20.02	19.96		9.53	9.50	1.14	19.94		1.70	20.70	9.91		
	nom						8.21					14.24				0.51	0.25
	min	3.43	5.92	0.08	19.61	19.66		9.27	9.29	0.89	18.92		1.45	20.45	9.65		
inches	max	0.187	0.243	0.006	0.788	0.786		0.375	0.374	0.045	0.785		0.067	0.815	0.39		
	nom						0.323					0.56				0.02	0.01
	min	0.135	0.233	0.003	0.772	0.774		0.365	0.366	0.035	0.745		0.057	0.805	0.38		

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

sot1214b_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1214B						~~14-03-27~~ 24-05-16

Fig 4. Package outline SOT1214B (sheet 1 of 2)

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SOT1214B

Drawing Notes	
Items	Description
(1)	Millimeter dimensions are derived from the original inch dimensions.
(2)	Dimension is measured 0.030 inch (0.76) from the body.

Package outline drawing: SOT1214B Publication	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.127 Angle: ± 1° Third angle projection	Revision: 4 Revision date: 5/16/2024 Sheet 2 of 2

Fig 5. Package outline SOT1214B (sheet 2 of 2)

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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.

Table 11. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C3
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1B

10. Abbreviations

Table 12. Abbreviations

Acronym	Description
GaN	Gallium Nitride
HEMT	High Electron Mobility Transistor
MTF	Median Time to Failure
RoHS	Restriction of Hazardous Substances
SiC	Silicon Carbide

11. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
CLF24H4LS300P v.1	20240730	Product 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.

[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".

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Date of release: 30 July 2024
Document identifier: CLF24H4LS300P