CLF3H0035-100; CLF3H0035S-100

Broadband RF power GaN HEMT

Rev. 2 — 28 September 2023

AMPLEON

Product data sheet

1. Product profile

1.1 General description

The CLF3H0035-100 and CLF3H0035S-100 are 100 W general purpose, unmatched broadband GaN HEMT transistors that are usable in the frequency range from DC to 3.5 GHz. The device utilizes a thermally enhanced package which supports both CW and pulsed applications.

Table 1. Typical performance

Typical RF performance at T_{case} = 25 °C; V_{DS} = 50 V; I_{Dq} = 300 mA; in a class-AB demo circuit, tested on straight lead device.

Test signal	f	$P_{L(1dB)}$	$P_{L(3dB)}$	G_p [1]	G_p [2]	G_p [3]	η_D [1]	η_D [2]	η_D [3]	η_D [4]	RL_{in} [5]	G_p [5]
	(MHz)	(W)	(W)	(dB)	(dB)	(dB)	(%)	(%)	(%)	(%)	(dB)	(dB)
pulsed CW [6]	500	75	100	14	-	15.8	72	-	67	73	–1	17.4
	1500	110	145	13.5	-	13.2	56	-	58	66	–3.8	15.4
	2500	90	110	14	-	15	50	-	48	50	–20	16.9
CW	500	70	102	-	14.3	15.5		69	64	72	-	-
	1500	90	135	-	12.5	12.5		53	53	64	-	-
	2500	75	102	-	13.5	14.4		46	44	47	-	-

[1] At P_L = 100 W.

[2] At P_L = 90 W.

[3] At $P_L = P_{L(1dB)}$.

[4] At $P_L = P_{L(3dB)}$.

[5] Small signal.

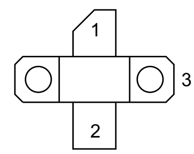
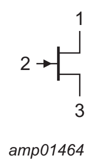
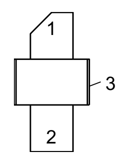
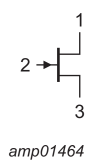
[6] t_p = 100 μs; δ = 30 %.

1.2 Features and benefits

- 100 W general purpose broadband RF power GaN HEMT
- High efficiency
- Low thermal resistance
- Excellent ruggedness
- Designed for broadband operation in the frequency range from DC to 3.5 GHz
- For RoHS compliance see the product details on the Ampleon website

2. Pinning information

Table 2. Pinning

Pin	Description		Simplified outline	Graphic symbol
CLF3H0035-100 (SOT467C)				
1	drain			
2	gate			
3	source	[1]		
CLF3H0035S-100 (SOT467B)				
1	drain			
2	gate			
3	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)
SOT467C	CLF3H0035-100U	9349 602 87112	Tray; 20-fold; non-dry pack	20
SOT467B	CLF3H0035S-100U	9349 602 88112	Tray; 20-fold; non-dry pack	20

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		-	150	V
V_{GS}	gate-source voltage		–8	+2	V
I_{GF}	forward gate current		-	16	mA
T_{stg}	storage temperature		–65	+200	°C
T_{ch}	active die channel temperature	[1]	-	300	°C

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

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	T_{case} = 81 °C; V_{DS} = 50 V; I_{Dq} = 160 mA; P_{dis} = 85 W	1.05	K/W
$R_{th(ch-c)(FEA)}$ [2]	thermal resistance from active die channel to case by Finite Element Analysis	T_{case} = 81 °C; V_{DS} = 50 V; I_{Dq} = 160 mA; P_{dis} = 85 W	1.6	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.

6. Characteristics

Table 6. DC characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = –8 V; I_D = 16 mA	150	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 6 V; I_D = 160 mA	-	–2.9	-	V
I_{DSX}	drain cut-off current	V_{GS} = 2 V; V_{DS} = 6 V	-	12.5	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 6 V	-	-	140	nA
g_{fs}	forward transconductance	V_{GS} = 0 V; V_{DS} = 6 V	-	3.9	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = 0 V; V_{DS} = 100 mV	-	240	-	mΩ

Table 7. AC characteristics

T_j = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	19.8	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	10.6	-	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	0.84	-	pF

Table 8. RF characteristics

RF characteristics in Ampleon production test circuit; typical RF performance at T_{case} = 25 °C; V_{DS} = 50 V; I_{Dq} = 160 mA; t_p = 100 μs; δ = 10 %; in a class-AB demo board, tested on straight lead device at a frequency of 2500 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_L	output power	$P_L = P_{L(3dB)}$	-	118	-	W
G_p	power gain	P_L = 100 W	14	15	-	dB
η_D	drain efficiency	P_L = 100 W	52	57	-	%
RL_{in}	input return loss	P_L = 100 W	-	–12	–8	dB

7. Test information

7.1 Ruggedness in class-AB operation

The CLF3H0035-100 and CLF3H0035S-100 are capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 50 V; f = 1300 MHz at rated load power on RF development board using CW RF signal.

7.2 Impedance information

Table 9. Typical impedance

Measured load-pull data; pulsed CW, I_{Dq} = 320 mA; δ = 10 %; t_p = 100 μs.Typical values unless otherwise specified.

f	Z_S [1]	Z_L [1]	G_p	η_D	P_L
(MHz)	(Ω)	(Ω)	(dB)	(%)	(W)
Maximum power load					
1000	1.21 + 1.63j	5.8 + 0.88j	20.0	64.5	174.5
2000	2.72 – 2.43j	6.1 – 0.38j	13.7	59.0	170.0
2500	1.93 – 6.62j	5.2 – 3.20j	12.8	57.0	160.0
3000	2.70 – 9.70j	5.9 – 4.80j	11.0	52.8	158.0
3500	5.50 – 16.0j	8.0 – 8.30j	10.6	46.5	155.0
Maximum drain efficiency load					
1000	1.21 + 1.63j	6.0 + 6.0j	21.5	78.0	124
2000	2.72 – 2.43j	4.7 + 4.3j	15.2	69.0	123
2500	1.93 – 6.62j	3.1 – 1.2j	14.2	63.6	124
3000	2.70 – 9.70j	3.9 – 2.8j	12.8	57.0	123
3500	5.50 – 16.0j	4.3 – 5.6j	12.1	53.0	121

[1] Z_S and Z_L defined in Figure 1.

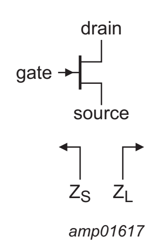
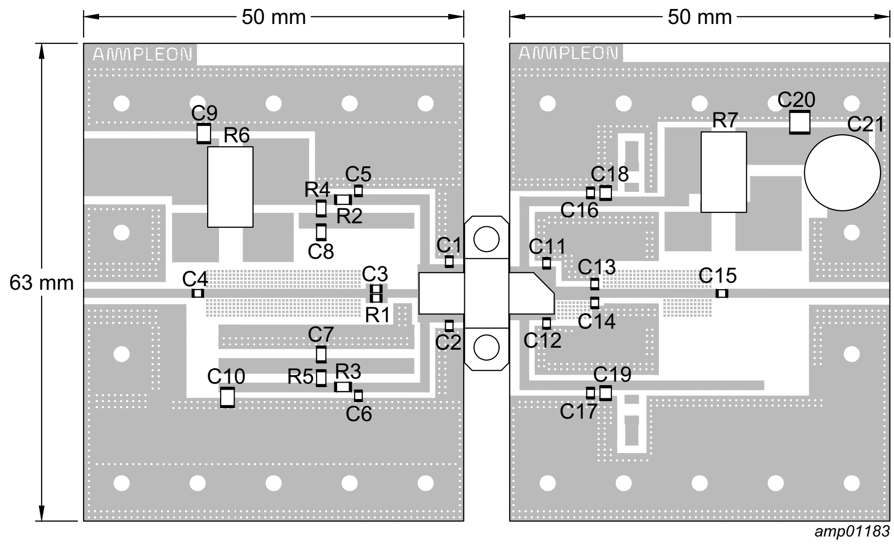


Fig 1. Definition of transistor impedance

7.3 Test circuit information



Printed-Circuit Board (PCB): Rogers 4350B; ε_r = 3.66 F/m; height = 0.762 mm; copper top/bottom metallization; thickness copper plating = 35 μm.

See Table 10 for list of components.

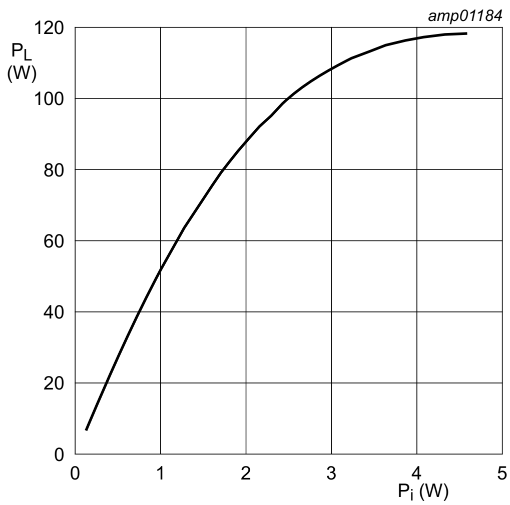
Fig 2. Component layout for production RF test circuit

Table 10. List of components

For test circuit see Figure 2.

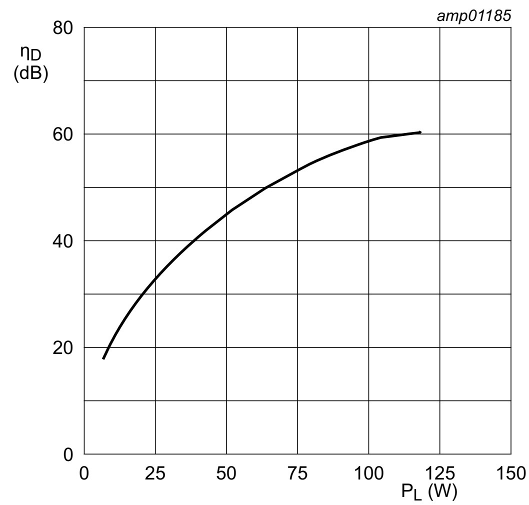
Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	1.9 pF	ATC 800A series
C3	multilayer ceramic chip capacitor	3 pF	ATC 800A series
C4, C15	multilayer ceramic chip capacitor	47 pF	ATC 800A series
C5, C6, C16, C17	multilayer ceramic chip capacitor	20 pF	ATC 800A series
C7, C8, C18, C19	multilayer ceramic chip capacitor	100 nF, 100 V	
C9, C10, C20	multilayer ceramic chip capacitor	4.7 μF, 100 V	
C11, C12	multilayer ceramic chip capacitor	2.7 pF	ATC 800A series
C13, C14	multilayer ceramic chip capacitor	0.9 pF	ATC 800A series
C21	electrolytic capacitor	4.7 μF, 63 V	
R1	resistor	100 Ω	SMD 0603
R2, R3	resistor	15 Ω	SMD 1206
R4, R5	resistor	10 Ω	SMD 1206
R6, R7	shunt resistor	10 mΩ	current monitoring

7.4 Graphical data



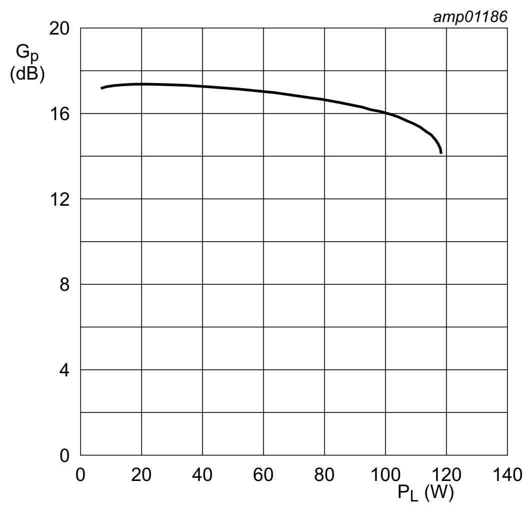
f = 2500 MHz; V_{DS} = 50 V; I_{Dq} = 160 mA; t_p = 100 μs; δ = 10 %.

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



f = 2500 MHz; V_{DS} = 50 V; I_{Dq} = 160 mA; t_p = 100 μs; δ = 10 %.

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

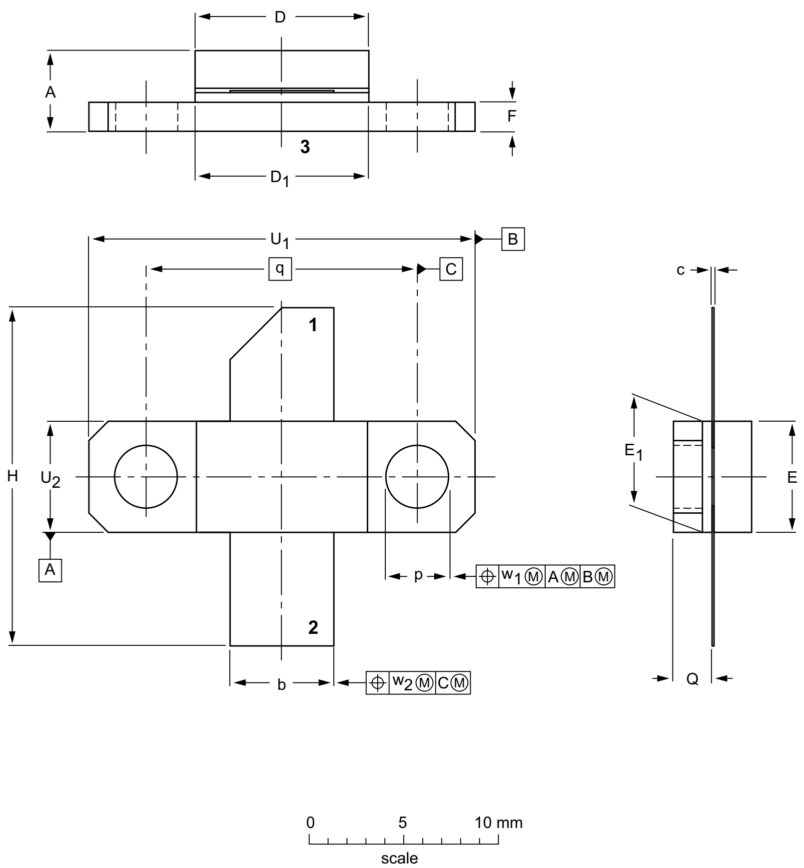


f = 1030 MHz; V_{DS} = 50 V; I_{Dq} = 160 mA; t_p = 100 μs; δ = 10 %.

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

8. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads **SOT467C**



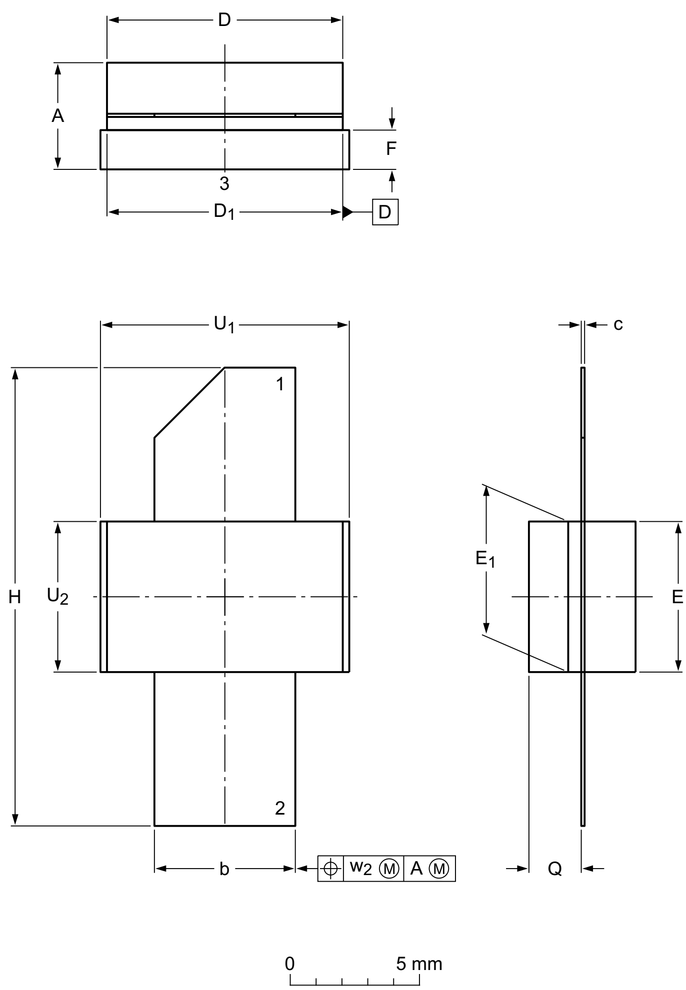
DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	p	Q	q	U_1	U_2	w_1	w_2
mm	4.67 3.94	5.59 5.33	0.15 0.10	9.25 9.04	9.27 9.02	5.92 5.77	5.97 5.72	1.65 1.40	18.54 17.02	3.43 3.18	2.21 1.96	14.27	20.45 20.19	5.97 5.72	0.25	0.51
inch	0.184 0.155	0.220 0.210	0.006 0.004	0.364 0.356	0.365 0.355	0.233 0.227	0.235 0.225	0.065 0.055	0.73 0.67	0.135 0.125	0.087 0.077	0.562	0.805 0.795	0.235 0.225	0.010	0.020

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT467C						~~99-12-28~~ 12-05-02

Fig 6. Package outline SOT467C

Earless ceramic package; 2 leads **SOT467B**



Dimensions

Unit[1]		A	b	c	D	D_1	E	E_1	F	H	Q	U_1	U_2	w_2
mm	max	4.67	5.59	0.15	9.25	9.27	5.92	5.97	1.65	18.29	2.21	9.78	5.97	
	nom													0.25
	min	3.94	5.33	0.10	9.04	9.02	5.77	5.72	1.40	17.27	1.96	9.53	5.72	
inches	max	0.184	0.22	0.006	0.364	0.365	0.233	0.235	0.065	0.72	0.087	0.385	0.235	
	nom													0.01
	min	0.155	0.21	0.004	0.356	0.355	0.227	0.225	0.055	0.68	0.077	0.375	0.225	

Note
1. millimeter dimensions are derived from the original inch dimensions.

sot467b_po

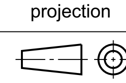
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT467B						~~11-08-18~~ 12-05-01

Fig 7. Package outline SOT467B

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	C2B [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1A [2]

[1] CDM classification C2B is granted to any part that passes after exposure to an ESD pulse of 750 V.

[2] HBM classification 1A is granted to any part that passes after exposure to an ESD pulse of 250 V.

10. Abbreviations

Table 12. Abbreviations

Acronym	Description
CW	Continuous Wave
EMC	ElectroMagnetic Compatibility
ESD	ElectroStatic Discharge
GaN	Gallium Nitride
HEMT	High Electron Mobility Transistor
MTF	Median Time to Failure
SMD	Surface Mounted Device
RoHS	Restriction of Hazardous Substances
VSWR	Voltage Standing Wave Ratio
WiMAX	Worldwide Interoperability for Microwave Access

11. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
CLF3H0035-100_H0035S-100 v.2	20230928	Product data sheet	-	CLF3H0035-100_H0035S-100 v.1
Modifications:	• Table 4 on page 2: updated table • Section 12 on page 10: updated section			
CLF3H0035-100_H0035S-100 v.1	20211223	Product 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.

[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.

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14. Contents

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