

# CLF3H0035-100; CLF3H0035S-100

Broadband RF power GaN HEMT

Rev. 1 — 23 December 2021

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  $T_{case} = 25\text{ °C}$ ;  $V_{DS} = 50\text{ V}$ ;  $I_{DQ} = 300\text{ mA}$ ; 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]	$\eta_D$ [1]	$\eta_D$ [2]	$\eta_D$ [3]	$\eta_D$ [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  $P_L = 100\text{ W}$ .

[2] At  $P_L = 90\text{ W}$ .

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

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

[5] Small signal.

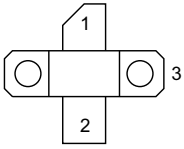
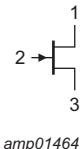
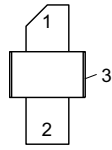
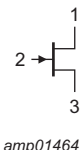
[6]  $t_p = 100\text{ }\mu\text{s}$ ;  $\delta = 30\text{ }\%$ .

### 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
<b>CLF3H0035-100 (SOT467C)</b>			
1	drain		 amp01464
2	gate		
3	source		
<b>CLF3H0035S-100 (SOT467B)</b>			
1	drain		 amp01464
2	gate		
3	source		

[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	+150	°C
$T_j$	junction temperature	[1]	-	225	°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	$T_{case} = 81\text{ °C}$ ; $V_{DS} = 50\text{ V}$ ; $I_{Dq} = 160\text{ mA}$ ; $P_{dis} = 85\text{ W}$	1.05	K/W
$R_{th(ch-c)(FEA)}$ [2]	thermal resistance from active die channel to case by Finite Element Analysis	$T_{case} = 81\text{ °C}$ ; $V_{DS} = 50\text{ V}$ ; $I_{Dq} = 160\text{ mA}$ ; $P_{dis} = 85\text{ W}$	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

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

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

Table 7. AC characteristics

$T_j = 25\text{ °C}$ ; unless otherwise specified.

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

Table 8. RF characteristics

RF characteristics in Ampleon production test circuit; typical RF performance at  $T_{case} = 25\text{ °C}$ ;  $V_{DS} = 50\text{ V}$ ;  $I_{Dq} = 160\text{ mA}$ ;  $t_p = 100\text{ μs}$ ;  $\delta = 10\%$ ; 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	$P_L = 100\text{ W}$	14	15	-	dB
$\eta_D$	drain efficiency	$P_L = 100\text{ W}$	52	57	-	%
$RL_{in}$	input return loss	$P_L = 100\text{ W}$	-	-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:  $V_{DS} = 50\text{ V}$ ;  $f = 1300\text{ MHz}$  at rated load power on RF development board using CW RF signal.

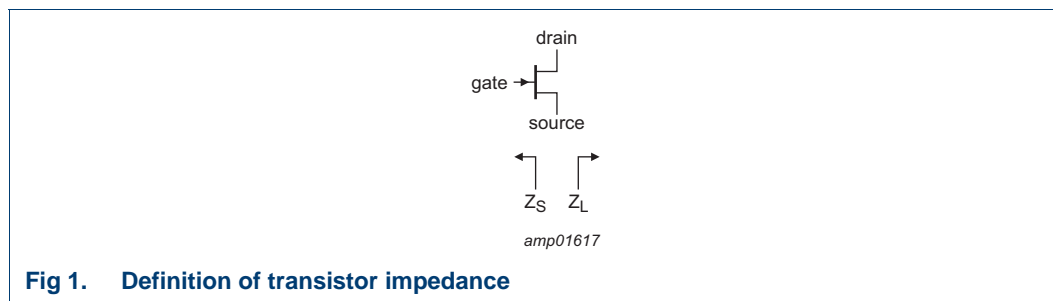
### 7.2 Impedance information

**Table 9. Typical impedance**

Measured load-pull data; pulsed CW,  $I_{DQ} = 320\text{ mA}$ ;  $\delta = 10\%$ ;  $t_p = 100\ \mu\text{s}$ . Typical values unless otherwise specified.

f (MHz)	Z <sub>S</sub> [1] ( $\Omega$ )	Z <sub>L</sub> [1] ( $\Omega$ )	G <sub>p</sub> (dB)	$\eta_D$ (%)	P <sub>L</sub> (W)
<b>Maximum power load</b>					
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
<b>Maximum drain efficiency load</b>					
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<sub>S</sub> and Z<sub>L</sub> defined in [Figure 1](#).



7.3 Test circuit information

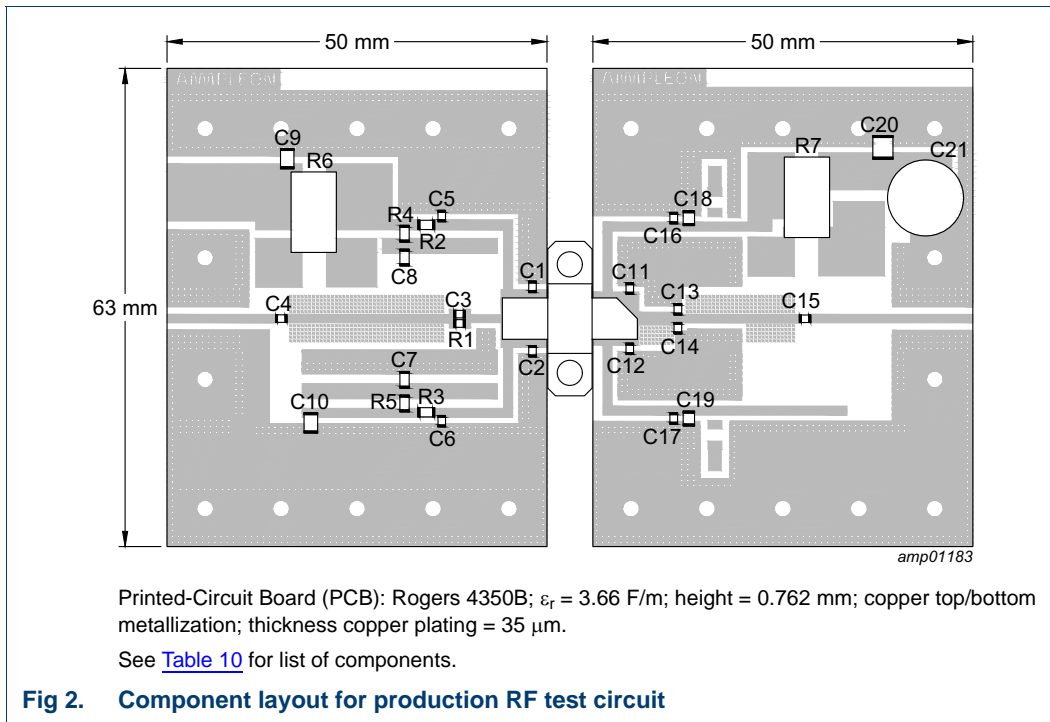
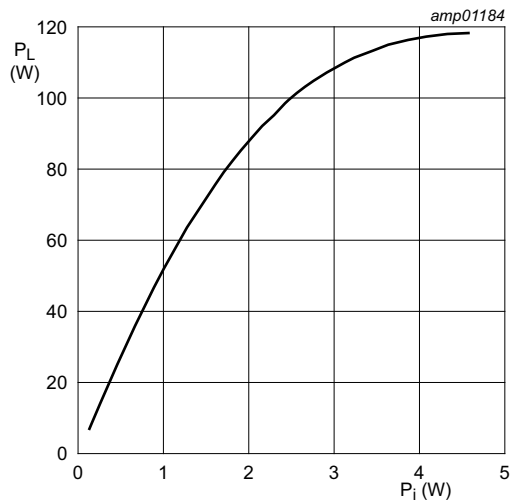


Table 10. List of components

For test circuit see [Figure 2](#).

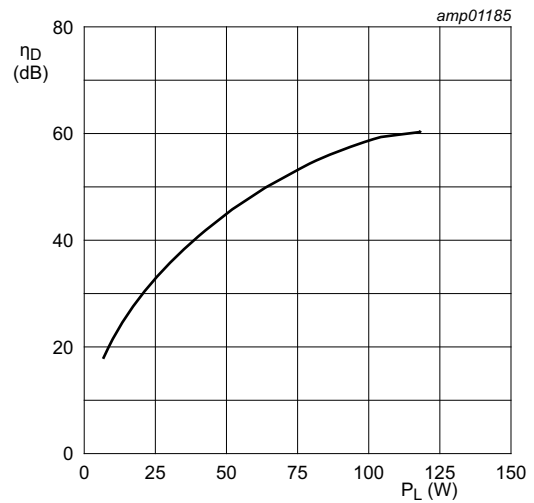
Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	1.9 pF	ATC 800A series
C3	multilayer ceramic chip capacitor	3 pF	ATC 800A series
C4, C15	multilayer ceramic chip capacitor	47 pF	ATC 800A series
C5, C6, C16, C17	multilayer ceramic chip capacitor	20 pF	ATC 800A series
C7, C8, C18, C19	multilayer ceramic chip capacitor	100 nF, 100 V	
C9, C10, C20	multilayer ceramic chip capacitor	4.7 $\mu\text{F}$ , 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 $\mu\text{F}$ , 63 V	
R1	resistor	100 $\Omega$	SMD 0603
R2, R3	resistor	15 $\Omega$	SMD 1206
R4, R5	resistor	10 $\Omega$	SMD 1206
R6, R7	shunt resistor	10 m $\Omega$	current monitoring

7.4 Graphical data



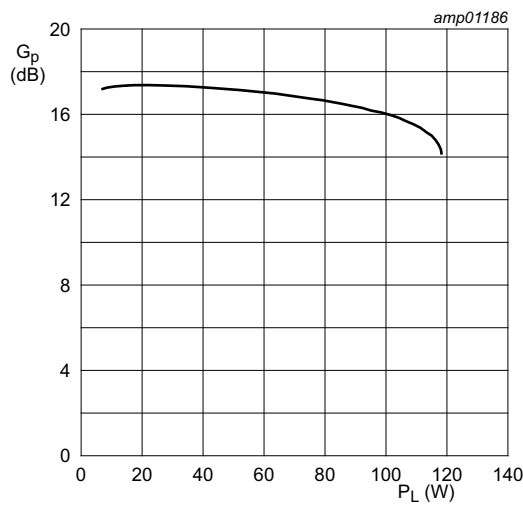
$f = 2500 \text{ MHz}; V_{DS} = 50 \text{ V}; I_{Dq} = 160 \text{ mA}; t_p = 100 \mu\text{s}; \delta = 10 \%$ .

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



$f = 2500 \text{ MHz}; V_{DS} = 50 \text{ V}; I_{Dq} = 160 \text{ mA}; t_p = 100 \mu\text{s}; \delta = 10 \%$ .

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



$f = 1030 \text{ MHz}; V_{DS} = 50 \text{ V}; I_{Dq} = 160 \text{ mA}; t_p = 100 \mu\text{s}; \delta = 10 \%$ .

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

8. Package outline

Flanged ceramic package; 2 mounting holes; 2 leads

SOT467C

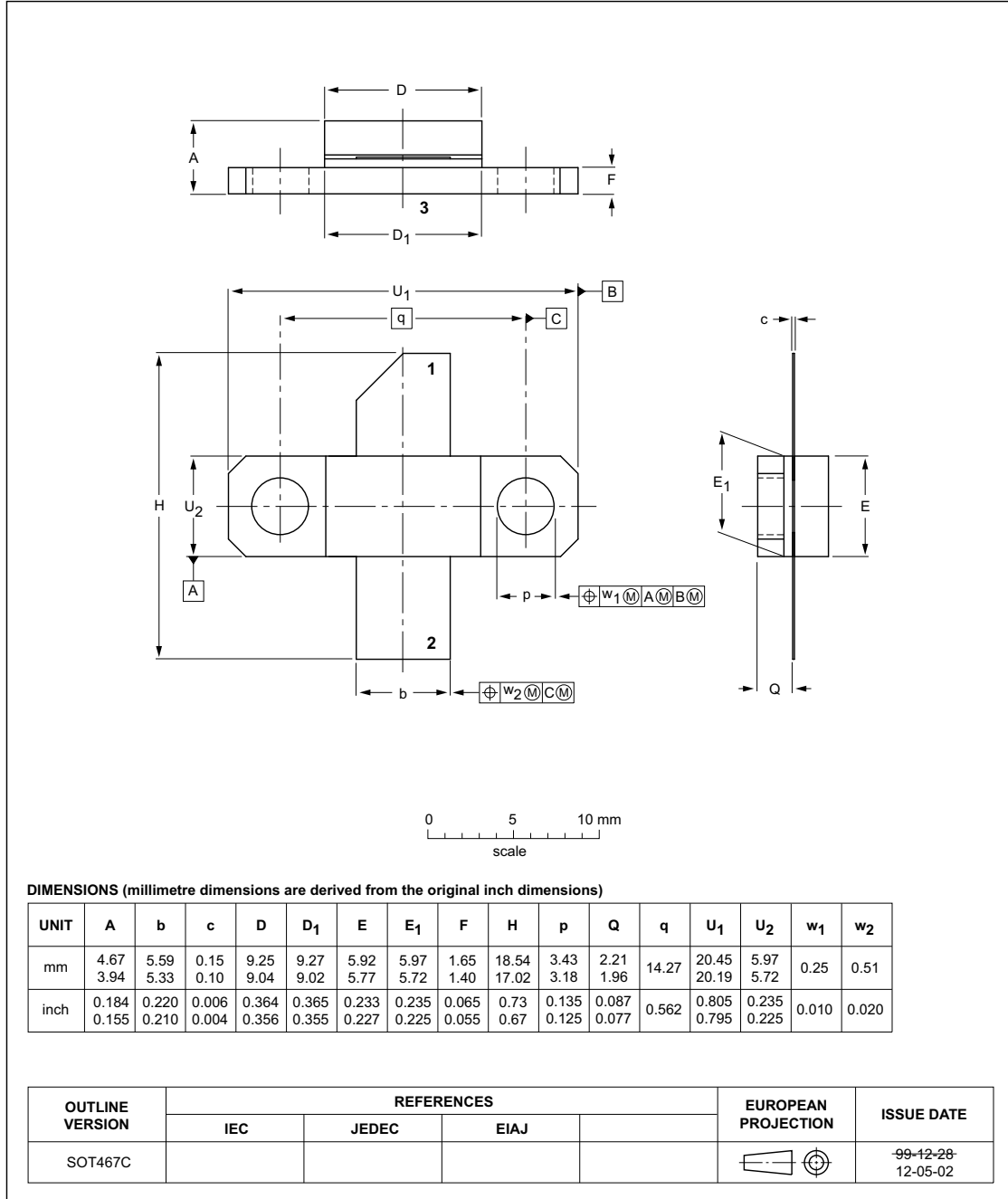


Fig 6. Package outline SOT467C

Earless ceramic package; 2 leads

SOT467B

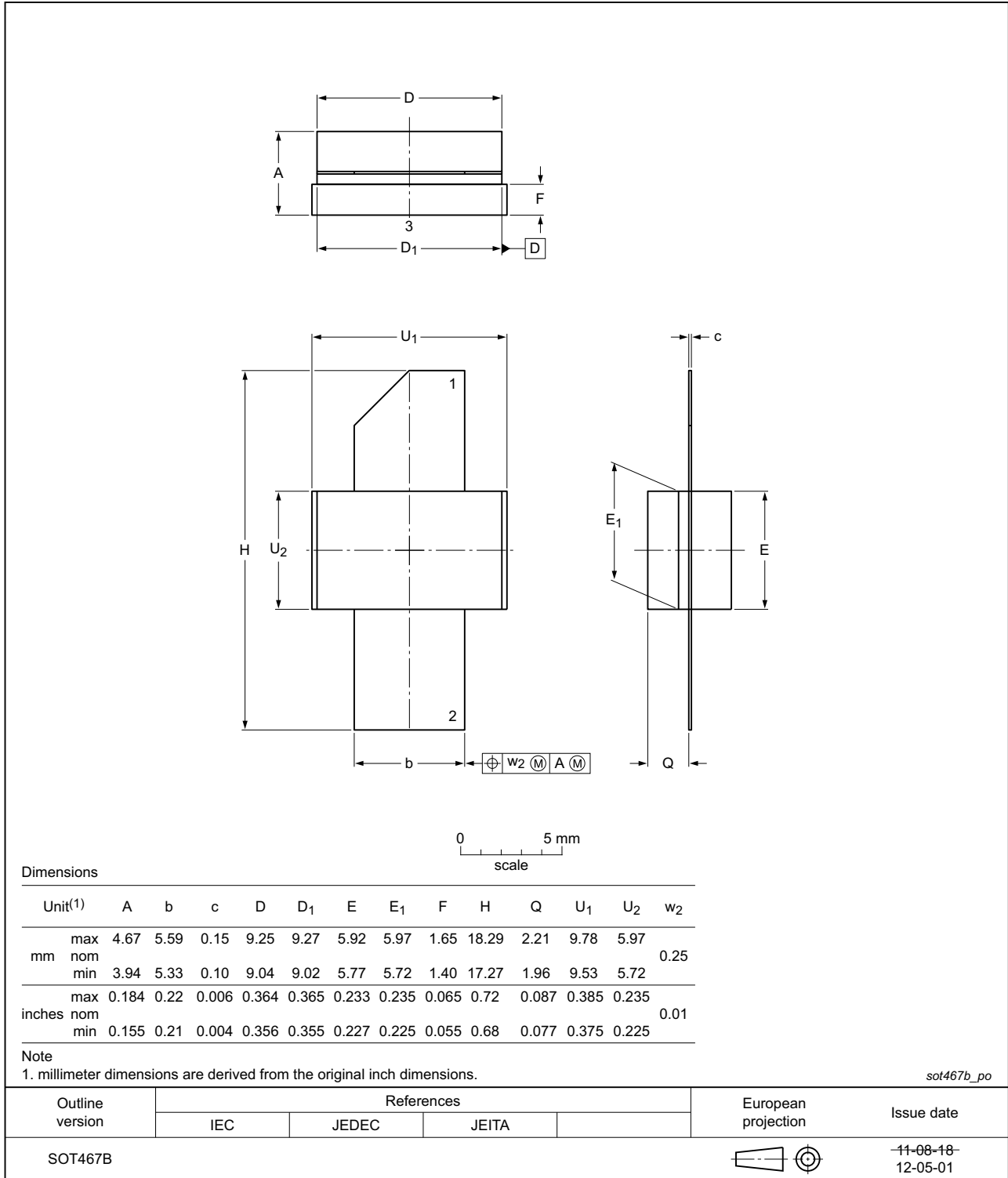


Fig 7. Package outline SOT467B



## 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 <a href="#">[1]</a>
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	1A <a href="#">[2]</a>

[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.1	20211223	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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