BLP9LA25S; BLP9LA25SG

Power LDMOS transistor

AMPLEON

Rev. 3 — 12 January 2023

Product data sheet

1. Product profile

1.1 General description

This 13.6 V 25 W device is designed for land mobile radio (LMR) applications supporting the frequency range from HF up to 941 MHz.

Table 1. Application performance

Typical RF performance at T_{case} = 25 °C; V_{DS} = 13.6 V; in a class-AB demo circuit.

Test signal	f	I_{Dq}	$P_{L(AV)}$	G_p	η_D	RL_{in}
	(MHz)	(mA)	(W)	(dB)	(%)	(dB)
CW	380 to 460	42	31	>16.5	>49.0	–7.3
	520	45	25	18.4	72.0	–15
	740 to 800	100	25	>15.7	>61.5	–5.7
	800 to 870	100	25	>14.2	>64.7	–5.3

1.2 Features and benefits

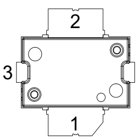
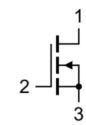
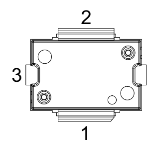
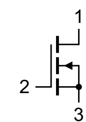
- High efficiency
- Integrated dual sided ESD protection
- Extreme ruggedness 65 : 1
- High power gain
- Excellent reliability
- Wideband
- High linearity
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- TETRA, SSB and LTE mobile radio applications in VHF and UHF bands
- Wideband radio application, frequency range from 380 MHz to 460 MHz and from 800 MHz to 870 MHz

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLP9LA25S (TO-270-2F-1)			
1	drain		 sym112
2	gate		
3	source [1]		
BLP9LA25SG (TO-270-2G-1)			
1	drain		 sym112
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)
TO-270-2F-1	BLP9LA25SZ	9349 602 91515	TR13; 500-fold; 24 mm; dry pack	500
	BLP9LA25SXY	9349 602 91538	TR7; 100-fold; 24 mm; dry pack	100
TO-270-2G-1	BLP9LA25SGZ	9349 603 15515	TR13; 500-fold; 24 mm; dry pack	500
	BLP9LA25SGXY	9349 603 15538	TR7; 100-fold; 24 mm; dry pack	100

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		-	40	V
V_{GS}	gate-source voltage		–5	+13	V
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
$R_{th(j-c)}$	thermal resistance from junction to case	T_{case} = 80 °C; V_{DS} = 13.6 V; P_L = 25 W	0.6	K/W

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 1.0 mA	40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 100 mA	1.5	2.0	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 13.6 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	19	-	A
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 = 100 mA	-	0.93	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 3.5 A	-	128	-	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} = 13.6 V; f = 1 MHz	-	96.9	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 13.6 V; f = 1 MHz	-	50.6	-	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0 V; V_{DS} = 13.6 V; f = 1 MHz	-	0.86	-	pF

Table 8. RF characteristics

Test signal: CW at V_{DS} = 13.6 V: I_{Dq} = 45 mA; T_{case} = 25 °C; unless otherwise specified; in a class-AB production circuit measured at frequencies of 520 MHz.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	P_L = 25 W	17.8	18.8	-	dB
RL_{in}	input return loss	P_L = 25 W	-	−18	-	dB
η_D	drain efficiency	P_L = 25 W	68	72	-	%

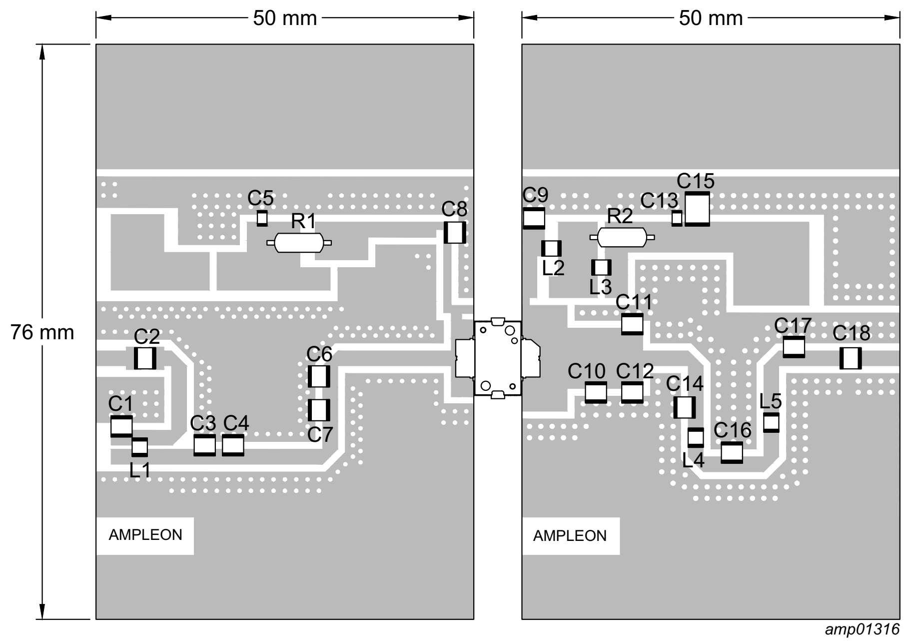
7. Test information

7.1 Ruggedness in class-AB operation

The BLP9LA25S and BLP9LA25SG are capable of withstanding a load mismatch corresponding to VSWR = 65 : 1 through all phases under the following conditions: V_{DS} = 13.6 V; I_{Dq} = 45 mA; P_L = 25 W (CW); f = 520 MHz.

7.2 Test circuit

7.2.1 Test circuit f = 380 MHz to 460 MHz



Printed-Circuit Board (PCB): Rogers RO4350B; height = 0.762 mm.

See Table 9 for a list of components.

Fig 1. Component layout for test circuit f = 380 MHz to 460 MHz

Table 9. List of components

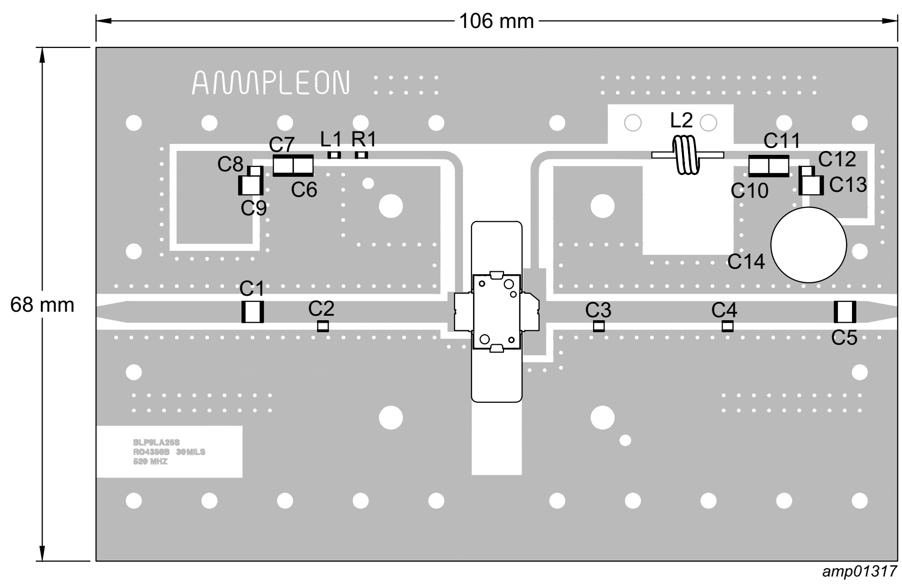
See Figure 1 for component layout.

Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	9.1 pF	ATC 100B
C2	multilayer ceramic chip capacitor	100 pF	ATC 100B
C3	multilayer ceramic chip capacitor	6.8 pF	ATC 100B
C4	multilayer ceramic chip capacitor	15 pF	ATC 100B
C5	multilayer ceramic chip capacitor	100 nF, 50 V	
C6	multilayer ceramic chip capacitor	33 pF	ATC 100B
C7	multilayer ceramic chip capacitor	16 pF	ATC 100B
C8	multilayer ceramic chip capacitor	120 pF	ATC 100B
C9	multilayer ceramic chip capacitor	22 pF	ATC 100B
C10	multilayer ceramic chip capacitor	56 pF	ATC 100B
C11	multilayer ceramic chip capacitor	15 pF	ATC 100B
C12	multilayer ceramic chip capacitor	62 pF	ATC 100B
C13	multilayer ceramic chip capacitor	100 nF, 50 V	
C14	multilayer ceramic chip capacitor	27 pF	ATC 100B
C15	multilayer ceramic chip capacitor	4.7 μF	
C16	multilayer ceramic chip capacitor	6.8 pF	ATC 100B

Table 9. List of components *...continued*
See Figure 1 for component layout.

Component	Description	Value	Remarks
C17	multilayer ceramic chip capacitor	1.7 pF	ATC 100B
C18	multilayer ceramic chip capacitor	100 pF	ATC 100B
L1	inductor air core	~6.9 nH	
L2	inductor air core	~23 nH	
L3	inductor air core	~22 nH	
L4, L5	wire one turn	~0.4 nH	
R1	axial resistor	68 Ω	
R2	axial resistor	49 Ω	

7.2.2 Test circuit f = 520 MHz



Printed-Circuit Board (PCB): Rogers RO4350B; height = 0.762 mm.

See Table 10 for a list of components.

Fig 2. Component layout for test circuit f = 520 MHz

Table 10. List of components
See Figure 2 for component layout.

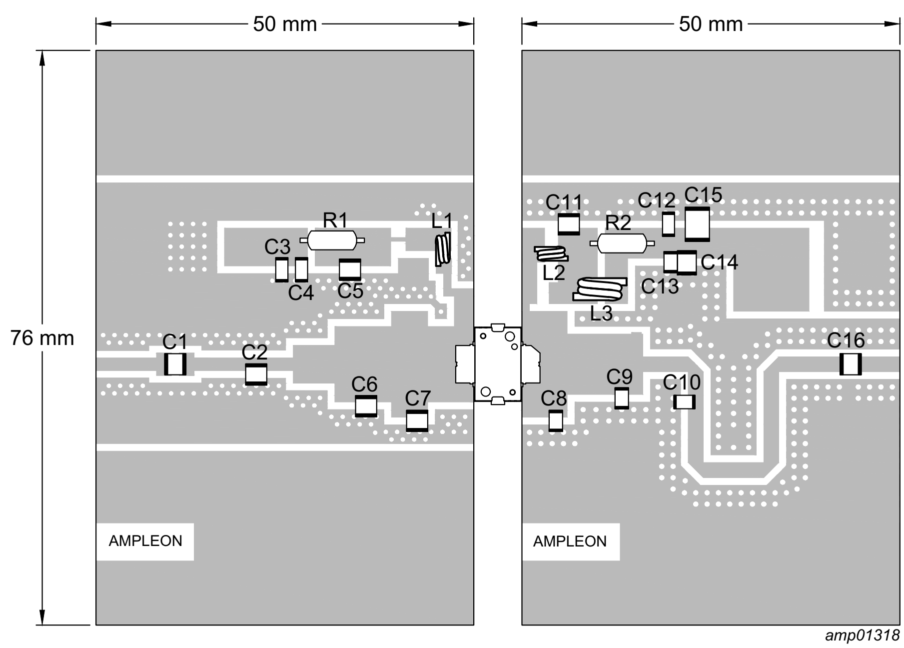
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	11 pF	ATC 100B
C2	multilayer ceramic chip capacitor	24 pF	ATC 600F
C3	multilayer ceramic chip capacitor	24 pF	ATC 600F
C4	multilayer ceramic chip capacitor	10 pF	ATC 600F
C5	multilayer ceramic chip capacitor	15 pF	ATC 100B
C6, C10	multilayer ceramic chip capacitor	22 pF	ATC 100B
C7, C11	multilayer ceramic chip capacitor	1 nF	ATC 100B
C8, C12	multilayer ceramic chip capacitor	0.1 μF	GRM21BR71H104KA01L

Table 10. List of components *...continued*

See Figure 2 for component layout.

Component	Description	Value	Remarks
C9, C13	multilayer ceramic chip capacitor	1 μF	GRM32RR71H105KA01L
C14	electrolytic capacitor	1000 μF, 63 V	
L1	wire wound inductor	43 nH	LQW18AN43NG80
L2	inductor air core	~53 nH	
R1	SMD	10 Ω	

7.2.3 Test circuit f = 740 MHz to 800 MHz and f = 800 MHz to 870 MHz



Printed-Circuit Board (PCB): Rogers RO4350B; height = 0.762 mm.

See Table 11 for a list of components.

Fig 3. Component layout for test circuit f = 740 MHz to 870 MHz

Table 11. List of components

See Figure 3 for component layout.

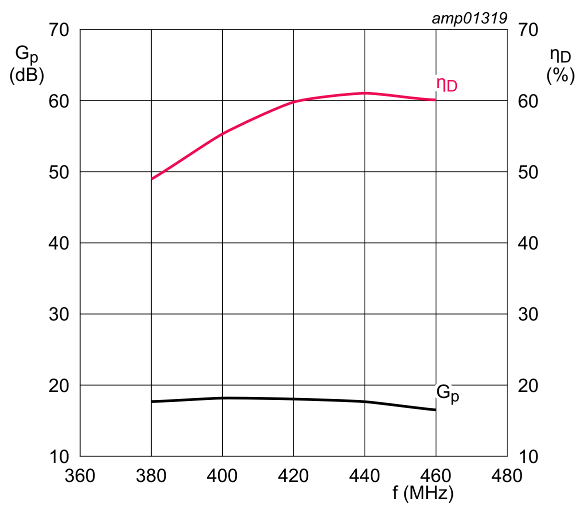
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	47 pF	ATC 100B
C2	multilayer ceramic chip capacitor	10 pF	ATC 100B
C3	multilayer ceramic chip capacitor	1 μF	GRM31MR71E105KA01L
C4	multilayer ceramic chip capacitor	100 nF	C1206C104K1RAC
C5	multilayer ceramic chip capacitor	220 pF	ATC 100B
C6	multilayer ceramic chip capacitor	8.2 pF	ATC 100B
C7	multilayer ceramic chip capacitor	18 pF	ATC 100B
C8	multilayer ceramic chip capacitor	18 pF	ATC 800B
C9	multilayer ceramic chip capacitor	16 pF	ATC 800B

Table 11. List of components *...continued*
See Figure 3 for component layout.

Component	Description	Value	Remarks
C10	multilayer ceramic chip capacitor	8.2 pF	ATC 800B
C11	multilayer ceramic chip capacitor	100 pF	ATC 100B
C12	multilayer ceramic chip capacitor	100 nF	C1206C104K1RAC
C13	multilayer ceramic chip capacitor	1 nF	ATC 100B
C14	multilayer ceramic chip capacitor	1 μF	GRM32RR71H105KA01L
C15	multilayer ceramic chip capacitor	10 μF, 50 V	
C16	multilayer ceramic chip capacitor	82 pF	ATC 800B
L1	inductor air core	~5 nH	
L2	inductor air core	~9 nH	
L3	inductor air core	~15 nH	
R1	axial resistor	68 Ω	
R2	axial resistor	10 Ω	

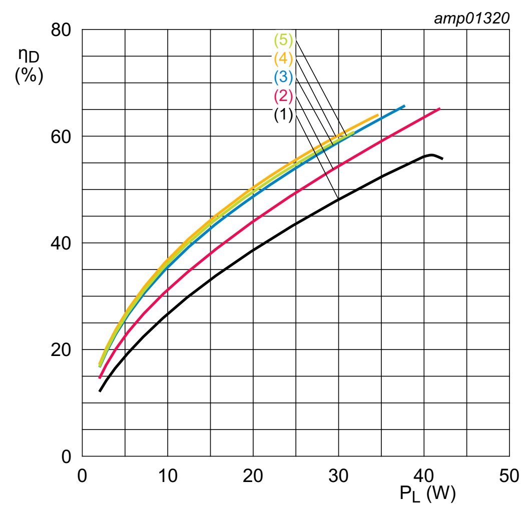
7.3 Graphical data

7.3.1 1-Tone CW measurements (f = 380 MHz to 460 MHz)



V_{DS} = 13.6 V; I_{Dq} = 42 mA; P_L = 31 W.

Fig 4. Power gain and drain efficiency as function of frequency; typical values



V_{DS} = 13.6 V; I_{Dq} = 42 mA.

(1) f = 380 MHz

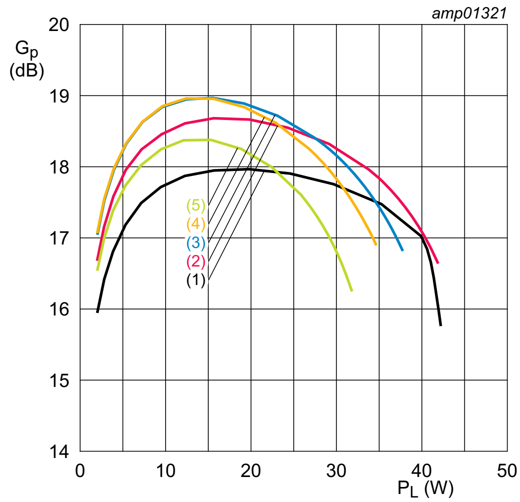
(2) f = 400 MHz

(3) f = 420 MHz

(4) f = 440 MHz

(5) f = 460 MHz

Fig 5. Drain efficiency as a function of output power; typical values



V_{DS} = 13.6 V; I_{Dq} = 42 mA.

(1) f = 380 MHz

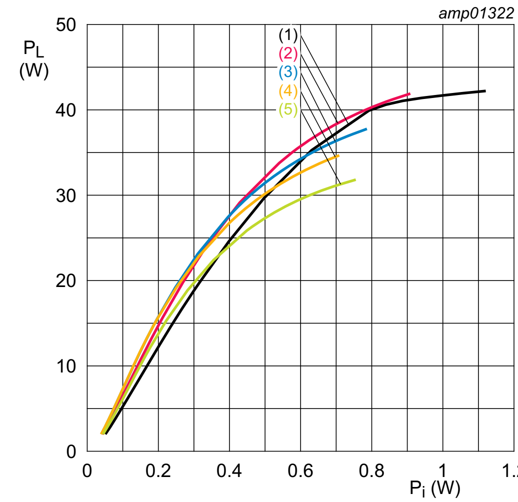
(2) f = 400 MHz

(3) f = 420 MHz

(4) f = 440 MHz

(5) f = 460 MHz

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



V_{DS} = 13.6 V; I_{Dq} = 42 mA.

(1) f = 380 MHz

(2) f = 400 MHz

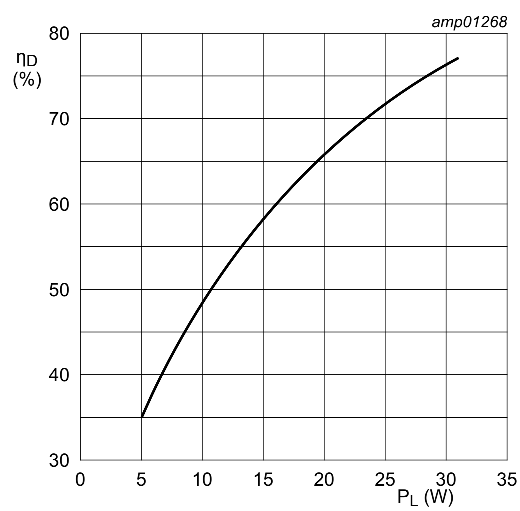
(3) f = 420 MHz

(4) f = 440 MHz

(5) f = 460 MHz

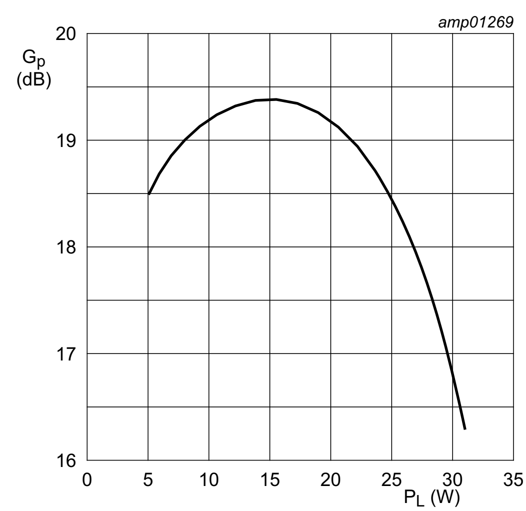
Fig 7. Output power as a function of input power; typical values

7.3.2 1-Tone CW measurements (f = 520 MHz)



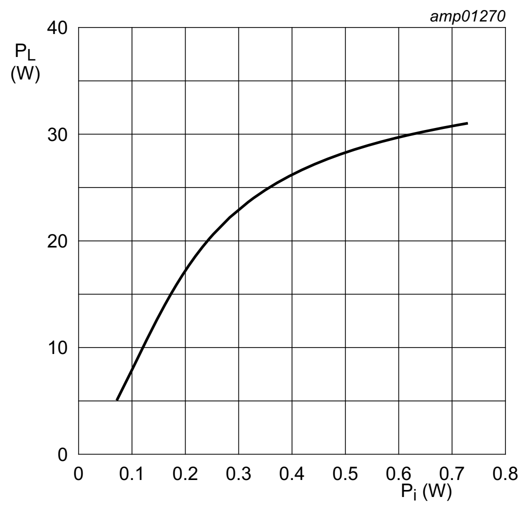
V_{DS} = 13.6 V; f = 520 MHz; I_{Dq} = 45 mA.

Fig 8. Drain efficiency as a function of output power; typical values



V_{DS} = 13.6 V; f = 520 MHz; I_{Dq} = 45 mA.

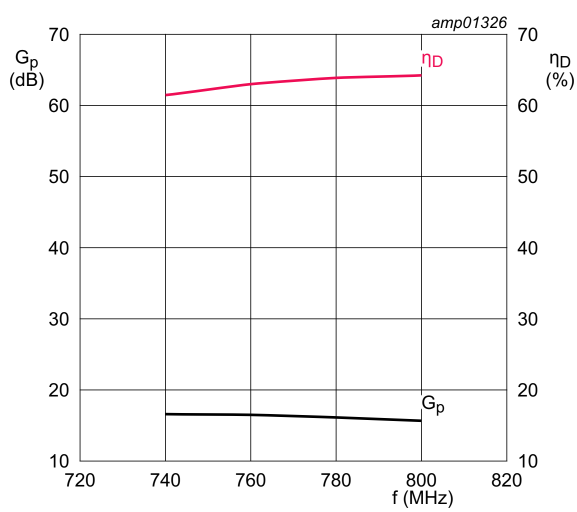
Fig 9. Power gain as a function of output power; typical values



V_{DS} = 13.6 V; f = 520 MHz; I_{Dq} = 45 mA.

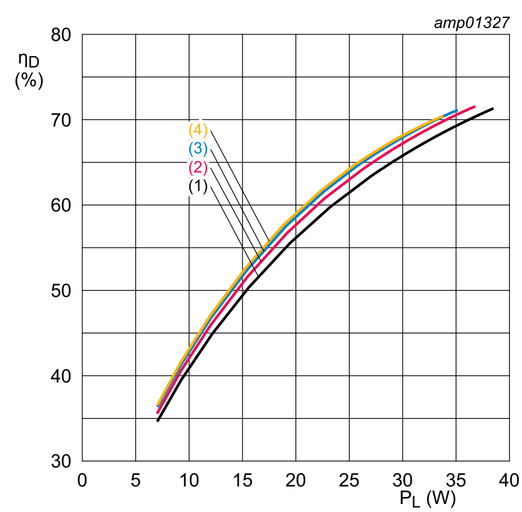
Fig 10. Output power as a function of input power; typical values

7.3.3 1-Tone CW measurements (f = 740 MHz to 800 MHz)



V_{DS} = 13.6 V; I_{Dq} = 100 mA; P_L = 25 W.

Fig 11. Power gain and drain efficiency as function of frequency; typical values



V_{DS} = 13.6 V; I_{Dq} = 100 mA.

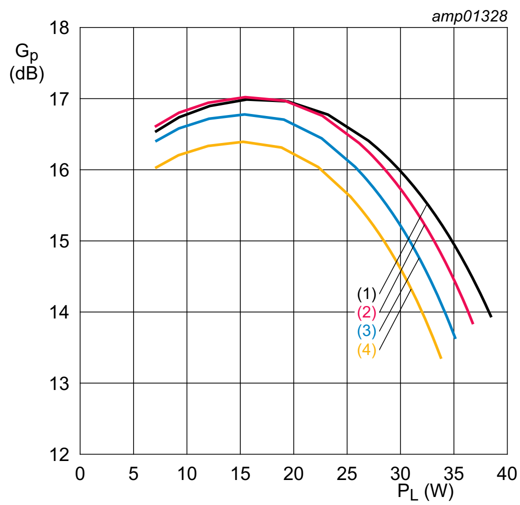
(1) f = 740 MHz

(2) f = 760 MHz

(3) f = 780 MHz

(4) f = 800 MHz

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



V_{DS} = 13.6 V; I_{Dq} = 100 mA.

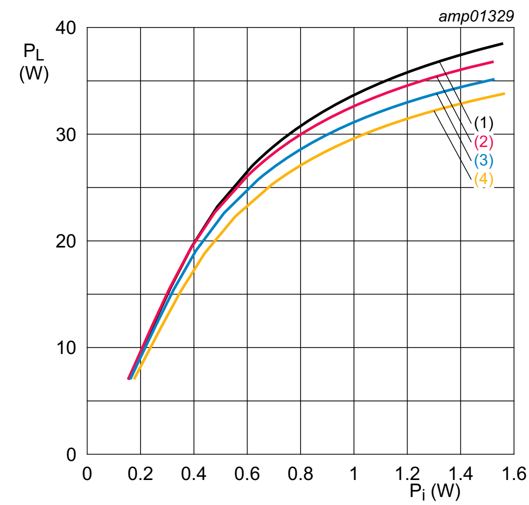
(1) f = 740 MHz

(2) f = 760 MHz

(3) f = 780 MHz

(4) f = 800 MHz

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



V_{DS} = 13.6 V; I_{Dq} = 100 mA.

(1) f = 740 MHz

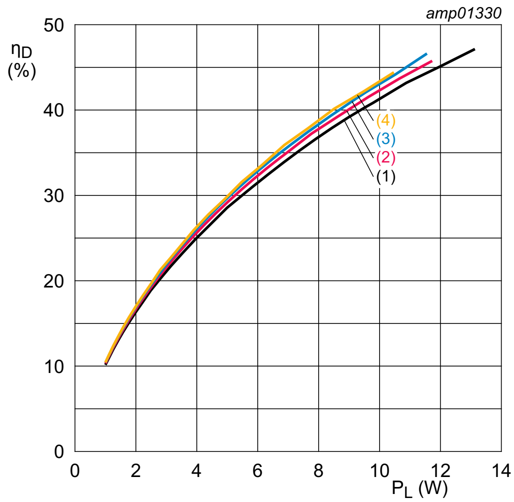
(2) f = 760 MHz

(3) f = 780 MHz

(4) f = 800 MHz

Fig 14. Output power as a function of input power; typical values

7.3.4 2-Tone CW measurements (f = 740 MHz to 800 MHz)



2-Tone signal with 100 kHz carrier separation: V_{DS} = 13.6 V; I_{Dq} = 500 mA.

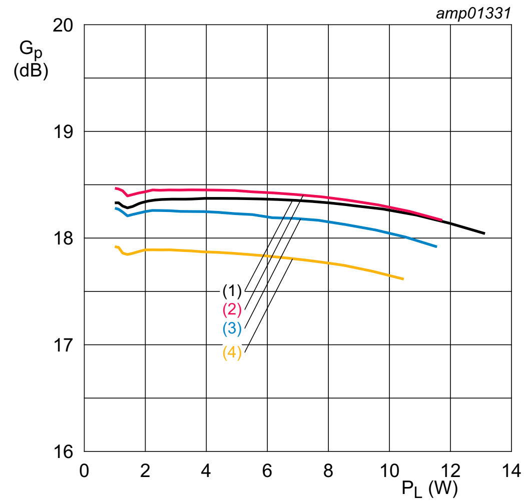
(1) f = 740 MHz

(2) f = 760 MHz

(3) f = 780 MHz

(4) f = 800 MHz

Fig 15. Drain efficiency as a function of output power; typical values



2-Tone signal with 100 kHz carrier separation: V_{DS} = 13.6 V; I_{Dq} = 500 mA.

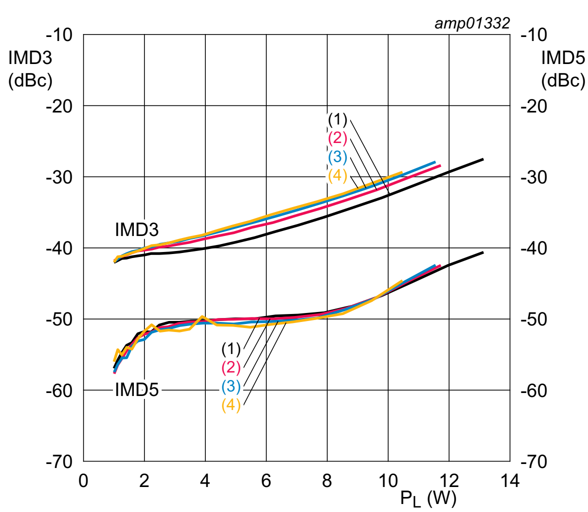
(1) f = 740 MHz

(2) f = 760 MHz

(3) f = 780 MHz

(4) f = 800 MHz

Fig 16. Power gain as a function of output power; typical values



2-Tone signal with 100 kHz carrier separation: V_{DS} = 13.6 V; I_{Dq} = 500 mA.

(1) f = 740 MHz

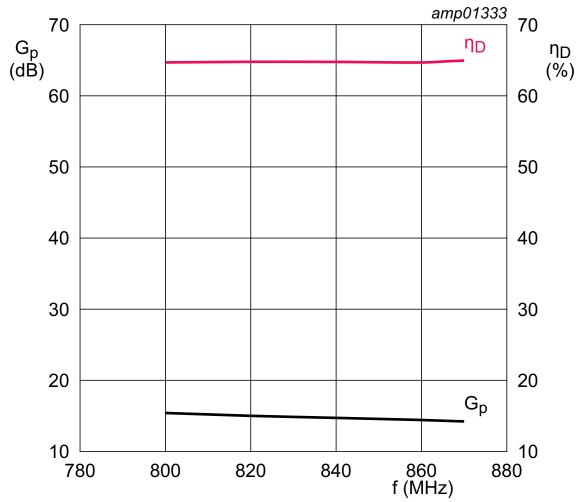
(2) f = 760 MHz

(3) f = 780 MHz

(4) f = 800 MHz

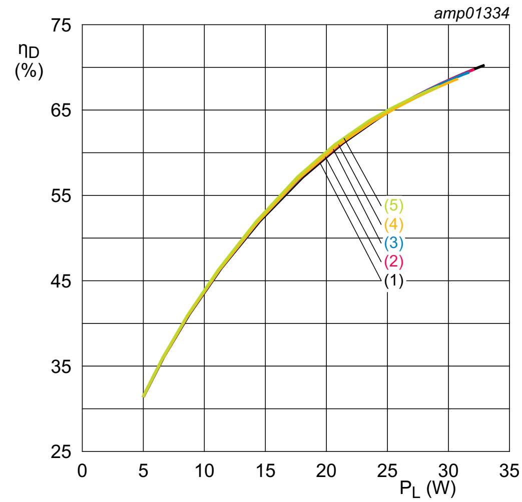
Fig 17. Intermodulation distortion as a function of output power; typical values

7.3.5 1-Tone CW measurements (f = 800 MHz to 870 MHz)



V_{DS} = 13.6 V; I_{Dq} = 100 mA; P_L = 25 W.

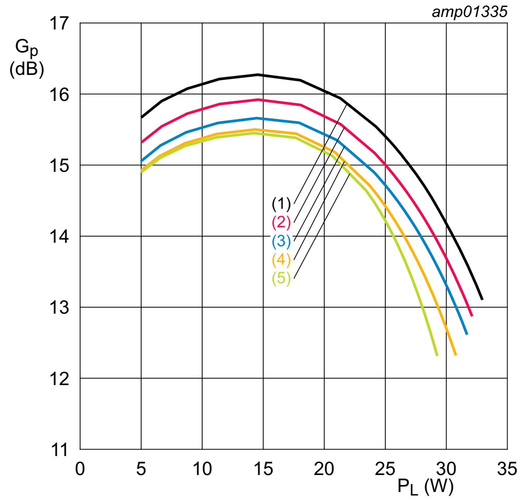
Fig 18. Power gain and drain efficiency as function of frequency; typical values



V_{DS} = 13.6 V; I_{Dq} = 100 mA.

(1) f = 800 MHz
(2) f = 820 MHz
(3) f = 840 MHz
(4) f = 860 MHz
(5) f = 870 MHz

Fig 19. Drain efficiency as a function of output power; typical values



V_{DS} = 13.6 V; I_{Dq} = 100 mA.

(1) f = 800 MHz

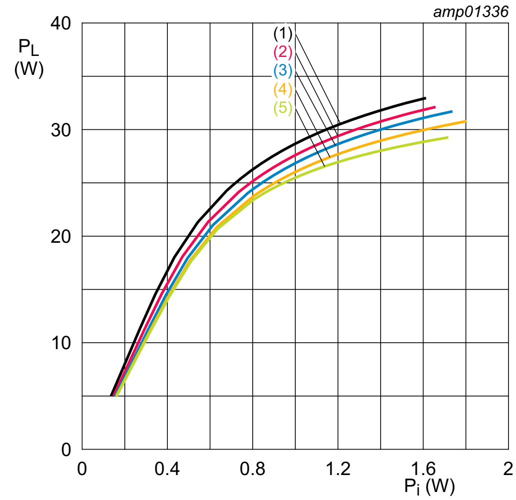
(2) f = 820 MHz

(3) f = 840 MHz

(4) f = 860 MHz

(5) f = 870 MHz

Fig 20. Power gain as a function of output power; typical values



V_{DS} = 13.6 V; I_{Dq} = 100 mA.

(1) f = 800 MHz

(2) f = 820 MHz

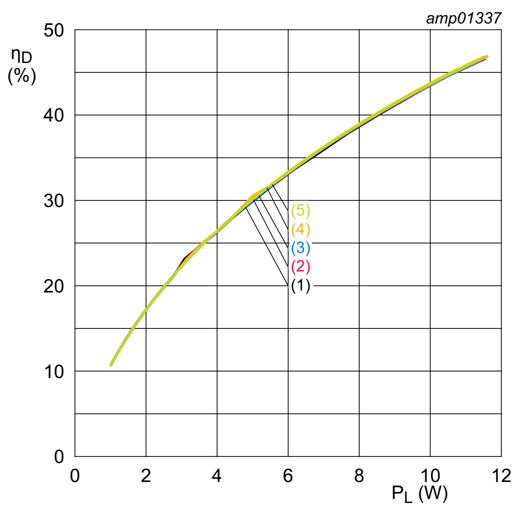
(3) f = 840 MHz

(4) f = 860 MHz

(5) f = 870 MHz

Fig 21. Output power as a function of input power; typical values

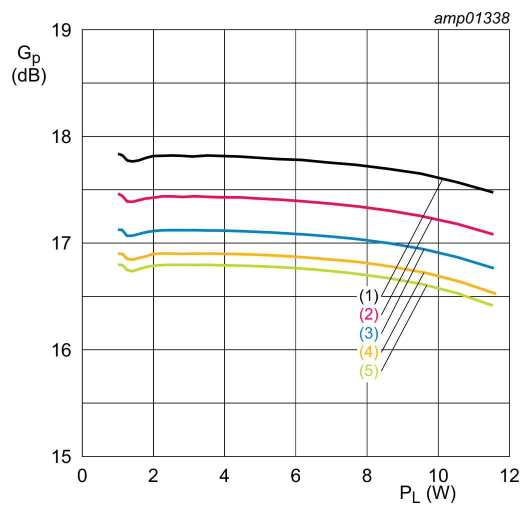
7.3.6 2-Tone CW measurements (f = 800 MHz to 870 MHz)



2-Tone signal with 100 kHz carrier separation: V_{DS} = 13.6 V; I_{Dq} = 500 mA.

(1) f = 800 MHz
(2) f = 820 MHz
(3) f = 840 MHz
(4) f = 860 MHz
(5) f = 870 MHz

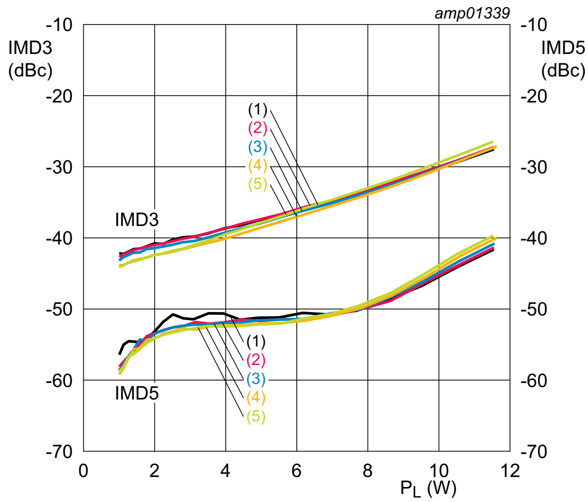
Fig 22. Drain efficiency as a function of output power; typical values



2-Tone signal with 100 kHz carrier separation: V_{DS} = 13.6 V; I_{Dq} = 500 mA.

(1) f = 800 MHz
(2) f = 820 MHz
(3) f = 840 MHz
(4) f = 860 MHz
(5) f = 870 MHz

Fig 23. Power gain as a function of output power; typical values



2-Tone signal with 100 kHz carrier separation: V_{DS} = 13.6 V; I_{Dq} = 500 mA.

(1) f = 800 MHz

(2) f = 820 MHz

(3) f = 840 MHz

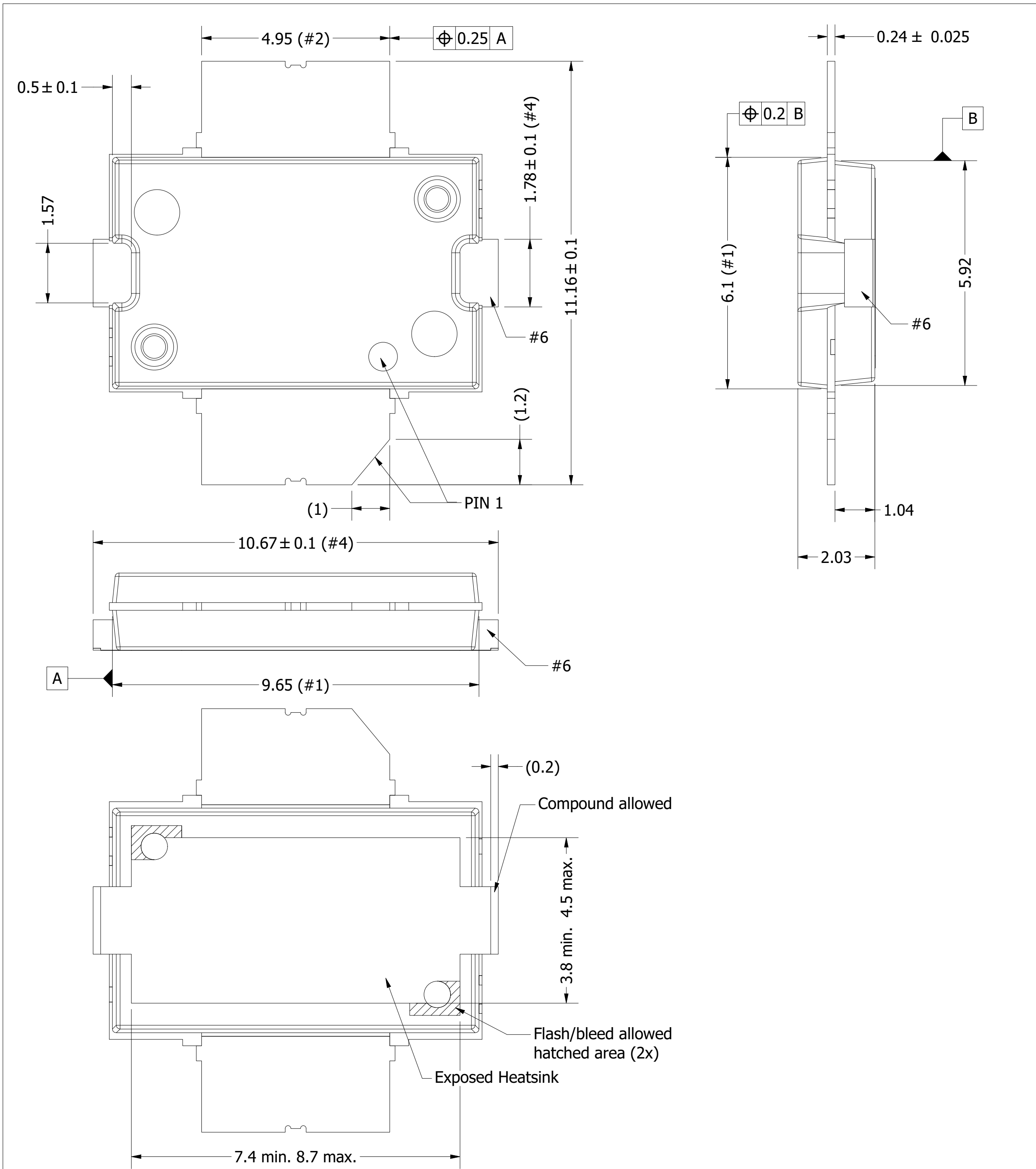
(4) f = 860 MHz

(5) f = 870 MHz

Fig 24. Intermodulation distortion as a function of output power; typical values

8. Package outline

TO-270-2F-1

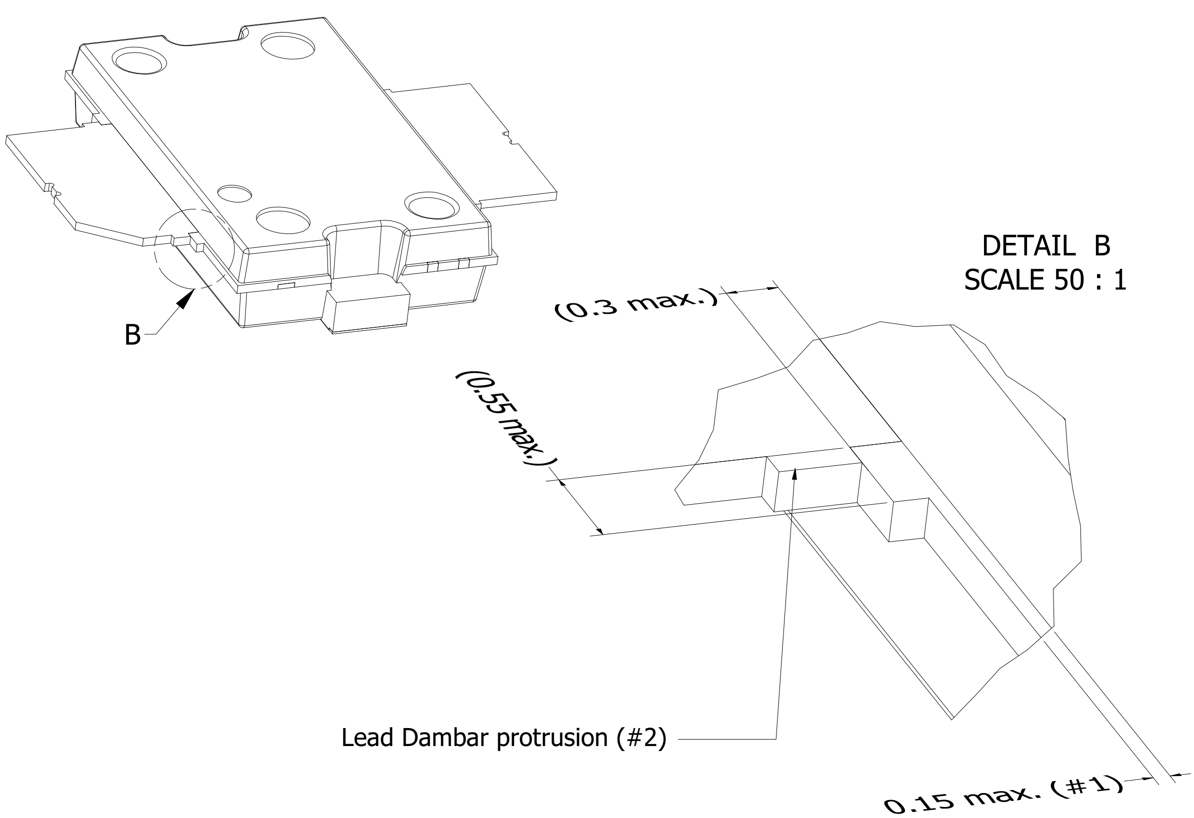


Package outline drawing: TO-270-2F-1	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 0 Revision date: 11/7/2022
		Third angle projection	Sheet 1 of 2

Fig 25. Package outline TO-270-2F-1 (sheet 1 of 2)

TO-270-2F-1

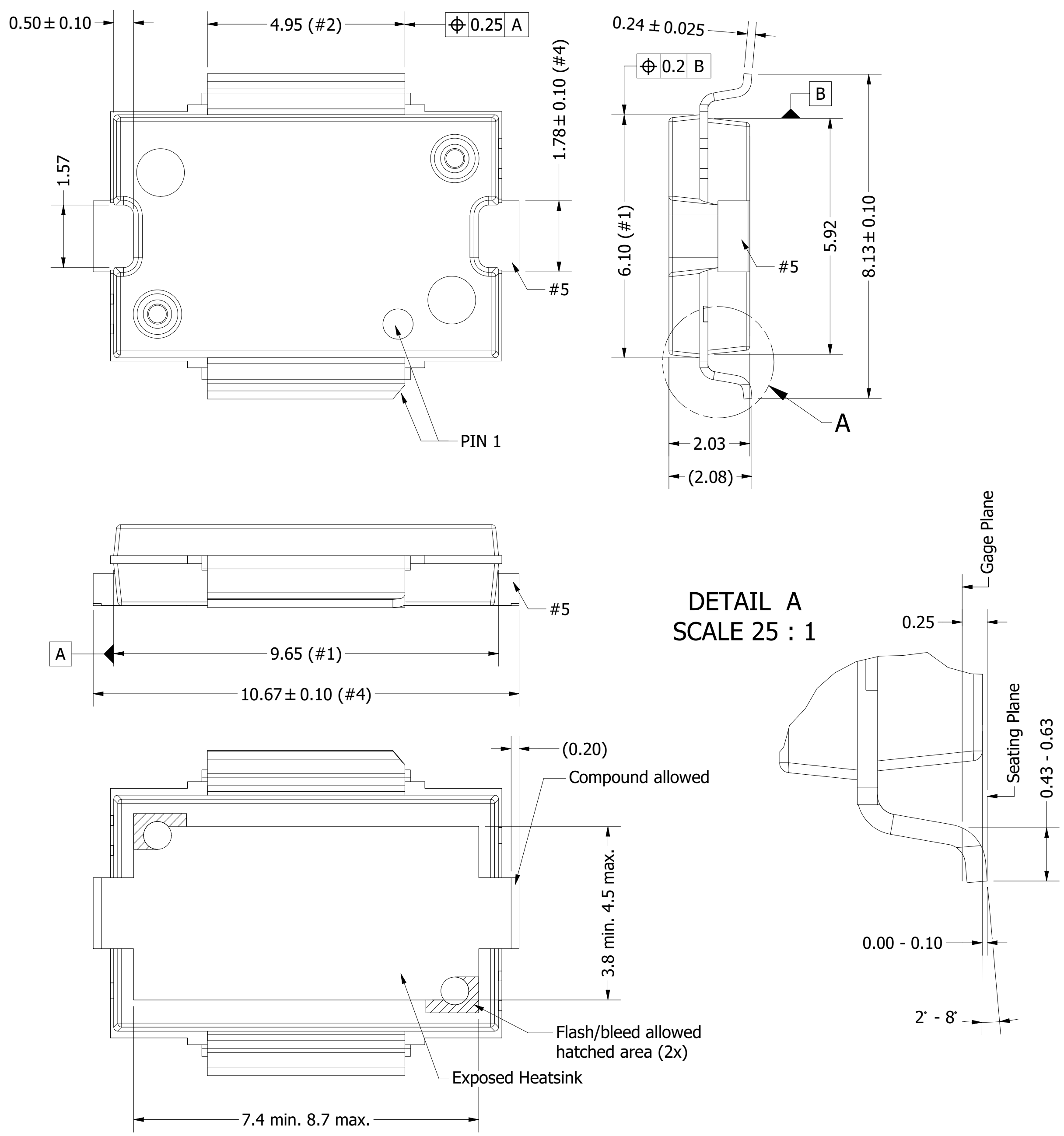
Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. The mold protrusion is maximum 0.15 mm per side. See also detail B. In the dambar area max. protrusion is 0.55 mm. max. in length and 0.3 mm. max. in width (4x). See also detail B.
(2)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(3)	The leads and exposed heatsink are plated with matte Tin (Sn).
(4)	Dimensions (Heatsink ears) 10,67 and 1,78 do not include mouldprotrusion. Overall Max. dimensions incl. mould protrusions is 10.92 mm. (max.) and 2.03 mm. (max.).
(5)	Lead coplanarity over the leads is 0,1 mm. maximum.
(6)	Surfaces may remain unplated (not solderable surfaces).



Package outline drawing: TO-270-2F-1	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 0 Revision date: 11/7/2022
		Third angle projection	Sheet 2 of 2

Fig 26. Package outline TO-270-2F-1 (sheet 2 of 2)

TO-270-2G-1

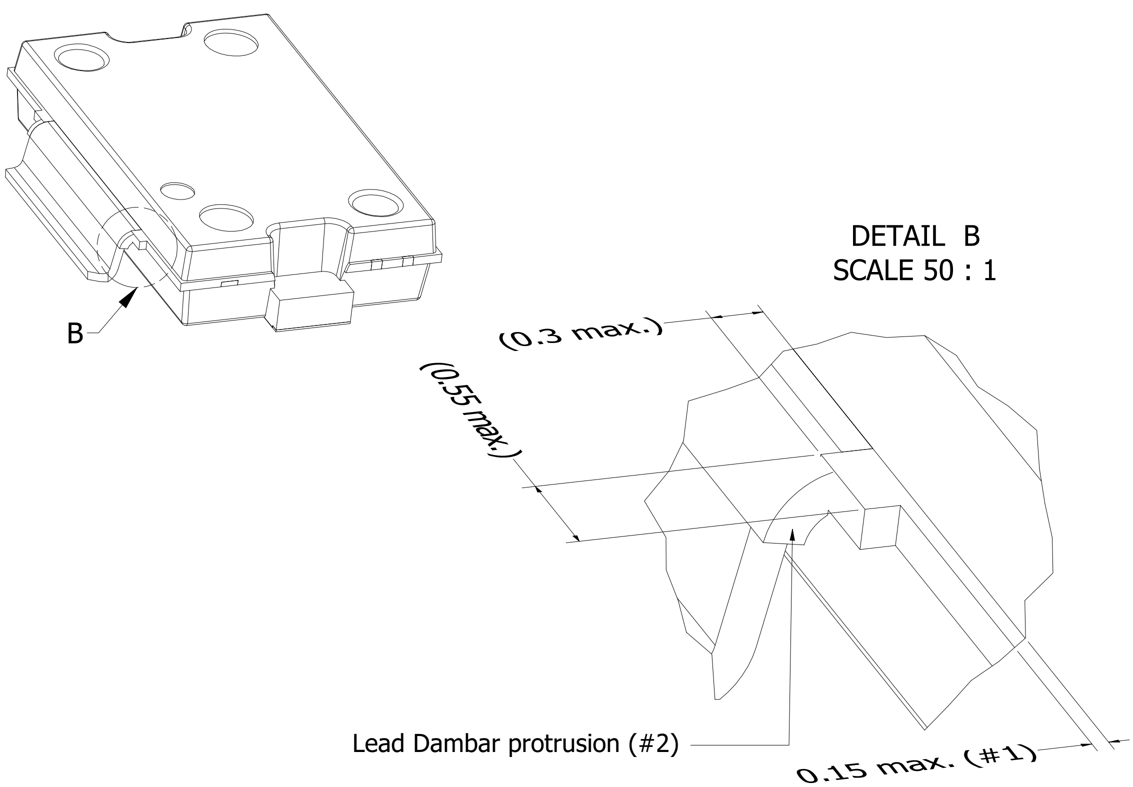


Package outline drawing: TO-270-2G-1	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 0 Revision date: 11/7/2022
		Third angle projection	Sheet 1 of 2

Fig 27. Package outline TO-270-2G-1 (sheet 1 of 2)

TO-270-2G-1

Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. The mold protrusion is maximum 0.15 mm per side. See also detail B. In the dambar area max. protrusion is 0.55mm max. in lenght and 0.3 mm max. in width (4x) See also detail B.
(2)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(3)	The leads and exposed heatsink are plated with matte Tin (Sn).
(4)	Dimensions (Heatsink ears) 10,67 and 1,78 do not include mouldprotrusion. Overall Max. dimensions incl. mould protrusions is 10,92 mm. (max.) and 2,03 mm. (max.).
(5)	Surfaces may remain unplated (not solderable surfaces).



Package outline drawing:	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 0 Revision date: 11/7/2022
TO-270-2G-1		Third angle projection	Sheet 2 of 2

Fig 28. Package outline TO-270-2G-1 (sheet 2 of 2)

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 12. ESD sensitivity

ESD model	Class
Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002	C2A [1]
Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001	2 [2]

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

10. Abbreviations

Table 13. Abbreviations

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LTE	Long Term Evolution
MTF	Median Time to Failure
RoHS	Restriction of Hazardous Substances
SSB	Single Side-Band
SMD	Surface Mounted Device
TETRA	TErrestrial Trunked Radio
UHF	Ultra High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

11. Revision history

Table 14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLP9LA25S_BLP9LA25SG v.3	20230112	Product data sheet	-	BLP9LA25S_BLP9LA25SG v.2
Modifications:	• Table 2 on page 2: package names changed from SOT1482-1 to TO-270-2F-1 and from SOT1483-1 to TO-270-2G-1 • Table 3 on page 2: package names changed from SOT1482-1 to TO-270-2F-1 and from SOT1483-1 to TO-270-2G-1 • Table 5 on page 3: value changed from 0.932 K/W to 0.6 K/W • Section 8 on page 16: package outline drawing changed from SOT1482-1 to TO-270-2F-1 and from SOT1483-1 to TO-270-2G-1 • Section 12 on page 22: updated section			
BLP9LA25S_BLP9LA25SG v.2	20210716	Product data sheet	-	BLP9LA25S_BLP9LA25SG v.1
BLP9LA25S_BLP9LA25SG v.1	20200616	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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