BLP05H6150XR

Power LDMOS transistor

Rev. 3 — 8 January 2016

AMPLEON

Product data sheet

1. Product profile

1.1 General description

A 150 W extremely rugged LDMOS power transistor for broadcast and industrial applications in the HF to 600 MHz band.

Table 1. Application information

Test signal	f	V_{DS}	P_L	G_p	η_D	ACPR
	(MHz)	(V)	(W)	(dB)	(%)	(dBc)
pulsed RF	108	50	150	27	75	-
CW	1.8 to 30	50	100	29	60	-
	135	50	150	26	73	-
	174 to 230	50	150	22	67	-
DVB-T	174 to 230	50	25	23	29	–36

1.2 Features and benefits

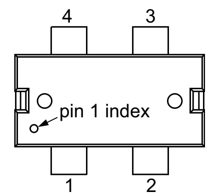
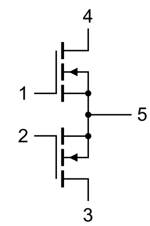
- Easy power control
- Integrated double sided ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- Industrial, scientific and medical applications
- Broadcast transmitter applications

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	gate 2		aaa-003574
2	gate 1		
3	drain 1		
4	drain 2		
5	source [1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLP05H6150XR	HSOP4F	plastic, heatsink small outline package; 4 leads(flat)	SOT1223-2

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		-	135	V
V_{GS}	gate-source voltage		–6	+11	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 on-line MTF calculator.

5. Thermal characteristics

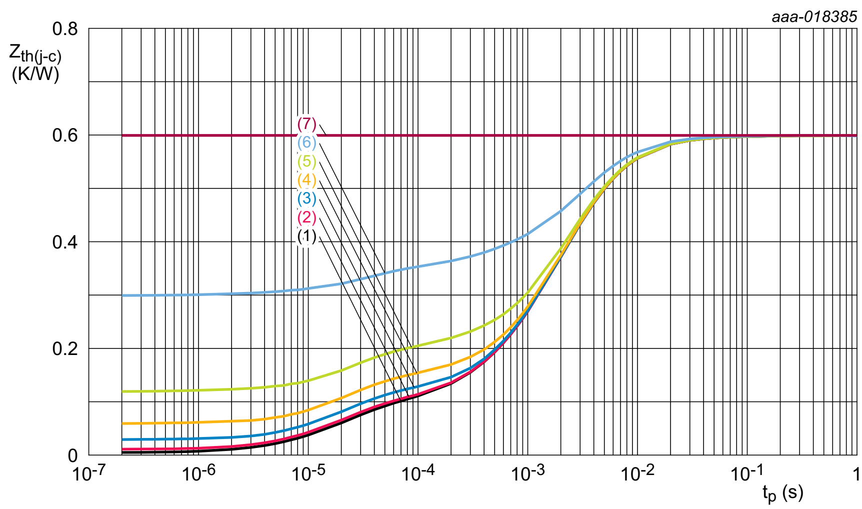
Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_j = 125 °C [1][2]	0.6	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	T_j = 150 °C; t_p = 100 μs; δ = 20 % [3]	0.21	K/W

[1] T_j is the junction temperature.

[2] $R_{th(j-c)}$ is measured under RF conditions.

[3] See Figure 1.



(1) δ = 1 %

(2) δ = 2 %

(3) δ = 5 %

(4) δ = 10 %

(5) δ = 20 %

(6) δ = 50 %

(7) δ = 100 % (DC)

Fig 1. Transient thermal impedance from junction to case as a function of pulse duration

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.5 mA	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 50 mA	1.25	1.8	2.25	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 50 V; I_D = 20 mA	-	1.7	-	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	7.2	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 1.75 A	-	0.8	-	Ω

Table 7. AC characteristics

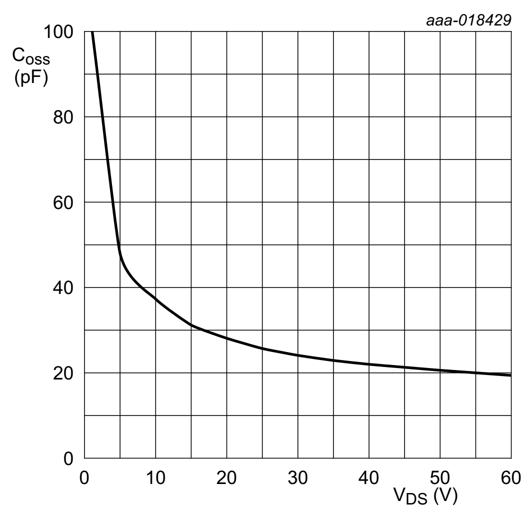
T_j = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{rs}	feedback capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	0.5	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	60	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	21	-	pF

Table 8. RF characteristics

Test signal: pulsed RF; t_p = 100 μs; δ = 20 %; f = 108 MHz; RF performance at V_{DS} = 50 V; I_{Dq} = 100 mA; T_{case} = 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 = 150 W	25.5	27	-	dB
RL_{in}	input return loss	P_L = 150 W	-	−8	-	dB
η_D	drain efficiency	P_L = 150 W	73	75	-	%



V_{GS} = 0 V; f = 1 MHz.

Fig 2. Output capacitance as a function of drain-source voltage; typical values per section

7. Test information

7.1 Ruggedness in class-AB operation

The BLP05H6150XR is capable of withstanding a load mismatch corresponding to VSWR > 65 : 1 through all phases under the following conditions: V_{DS} = 50 V; I_{Dq} = 40 mA; P_L = 150 W pulsed; f = 108 MHz.

7.2 Impedance information

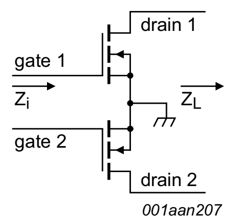


Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and P_L = 150 W.

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
108	32 – j99	25 + j6.0

7.3 UIS avalanche energy

Table 10. Typical avalanche data per section

T_{amb} = 25 °C; typical test data; test jig without water cooling.

I_{AS}	E_{AS}
(A)	(J)
4	0.38
5	0.26
6	0.18

For information see application note *AN10273*.

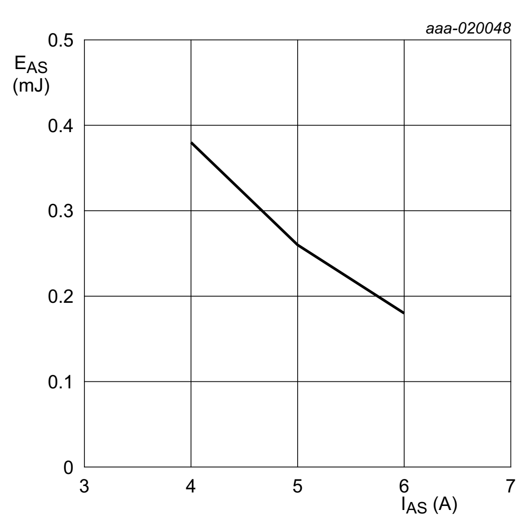
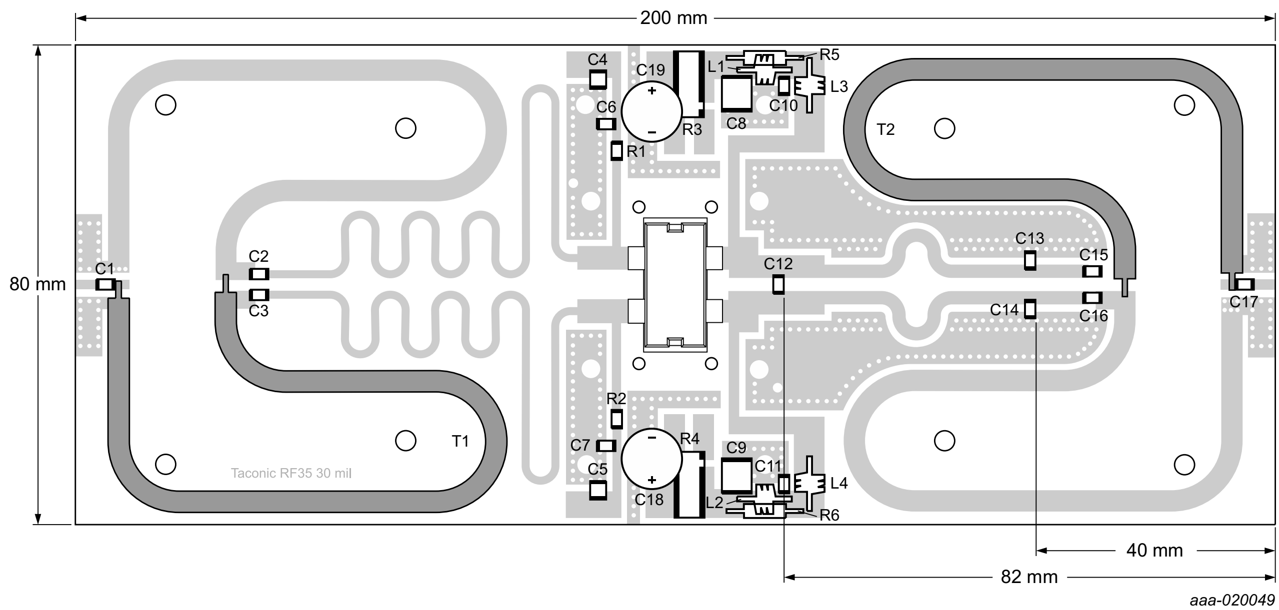


Fig 4. Non-repetitive avalanche energy as a function of single pulse avalanche current; typical values

7.4 Test circuit



Printed-Circuit Board (PCB): RF-35; ε_r = 3.5 F/m; thickness = 0.765 mm; thickness copper plating = 35 μm.

See Table 11 for a list of components.

Fig 5. Component layout for class-AB production test circuit

Table 11. List of components

For test circuit see Figure 5.

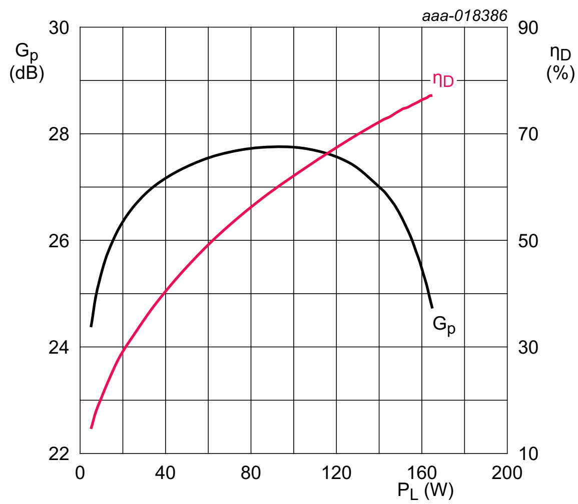
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	68 pF [1]	
C2, C3	multilayer ceramic chip capacitor	220 pF [1]	
C4, C5	multilayer ceramic chip capacitor	4.7 μF, 50 V	Kemet: C1210X475K5RAC-T4
C6, C7	multilayer ceramic chip capacitor	750 pF [1]	
C8, C9	multilayer ceramic chip capacitor	4.7 μF, 100 V	TDK: C5750X7R2A475KT
C10, C11	multilayer ceramic chip capacitor	750 pF [1]	
C12	multilayer ceramic chip capacitor	10 pF [1]	
C13, C14	multilayer ceramic chip capacitor	43 pF [1]	
C15, C16	multilayer ceramic chip capacitor	390 pF [1]	
C17	multilayer ceramic chip capacitor	47 pF [1]	
C18,C19	electrolytic capacitor	2200 μF, 64 V	
L1, L2	wire inductor	5 turns, D = 3 mm, 1 mm copper wire	
L3, L4	wire inductor	6 turns, D = 3 mm, 1 mm copper wire	
R1, R2	resistor	4.7 kΩ	SMD 1206
R3, R4	shunt resistor	0.01 Ω	Ohmite: FC4L110R010FER
R5, R6	metal film resistor	10 Ω, 0.6 W	
T1, T2	semi rigid coax	50 Ω, length = 160 mm	EZ Form: EZ-141-AL-TP-M17

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

7.5 Graphical data

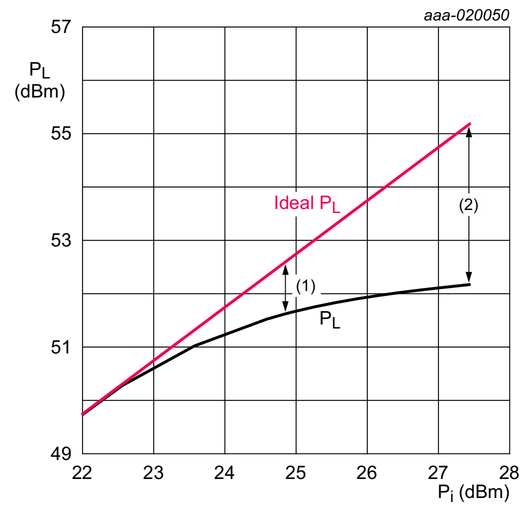
The following figures are measured in a class-AB production test circuit.

7.5.1 1-Tone CW pulsed



V_{DS} = 50 V; I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

Fig 6. Power gain and drain efficiency as function of output power; typical values

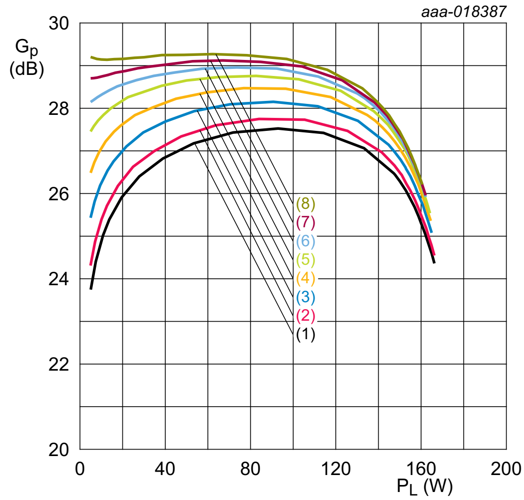


V_{DS} = 50 V; I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) $P_{L(1dB)}$ = 51.6 dBm (146 W)

(2) $P_{L(3dB)}$ = 52.2 dBm (165 W)

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



V_{DS} = 50 V; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) I_{Dq} = 20 mA

(2) I_{Dq} = 40 mA

(3) I_{Dq} = 100 mA

(4) I_{Dq} = 200 mA

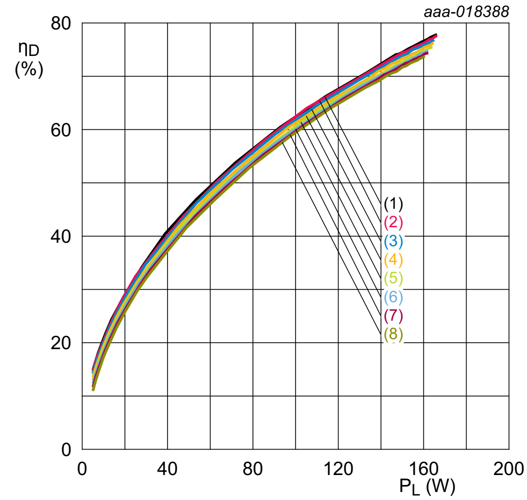
(5) I_{Dq} = 300 mA

(6) I_{Dq} = 400 mA

(7) I_{Dq} = 500 mA

(8) I_{Dq} = 600 mA

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



V_{DS} = 50 V; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) I_{Dq} = 20 mA

(2) I_{Dq} = 40 mA

(3) I_{Dq} = 100 mA

(4) I_{Dq} = 200 mA

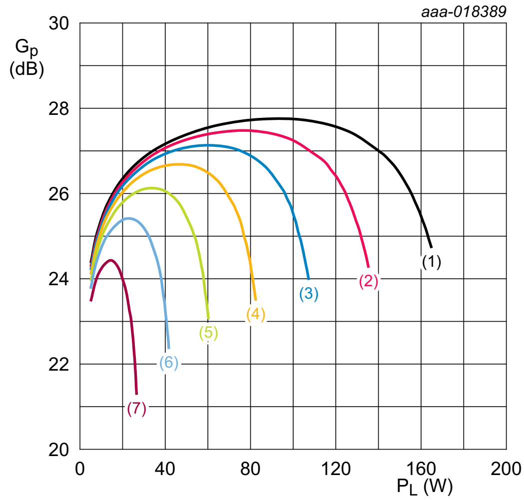
(5) I_{Dq} = 300 mA

(6) I_{Dq} = 400 mA

(7) I_{Dq} = 500 mA

(8) I_{Dq} = 600 mA

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



I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) V_{DS} = 50 V

(2) V_{DS} = 45 V

(3) V_{DS} = 40 V

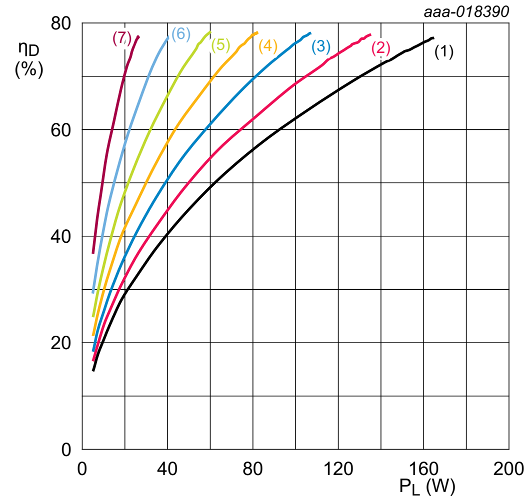
(4) V_{DS} = 35 V

(5) V_{DS} = 30 V

(6) V_{DS} = 25 V

(7) V_{DS} = 20 V

Fig 10. Power gain as a function of output power; typical values



I_{Dq} = 40 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) V_{DS} = 50 V

(2) V_{DS} = 45 V

(3) V_{DS} = 40 V

(4) V_{DS} = 35 V

(5) V_{DS} = 30 V

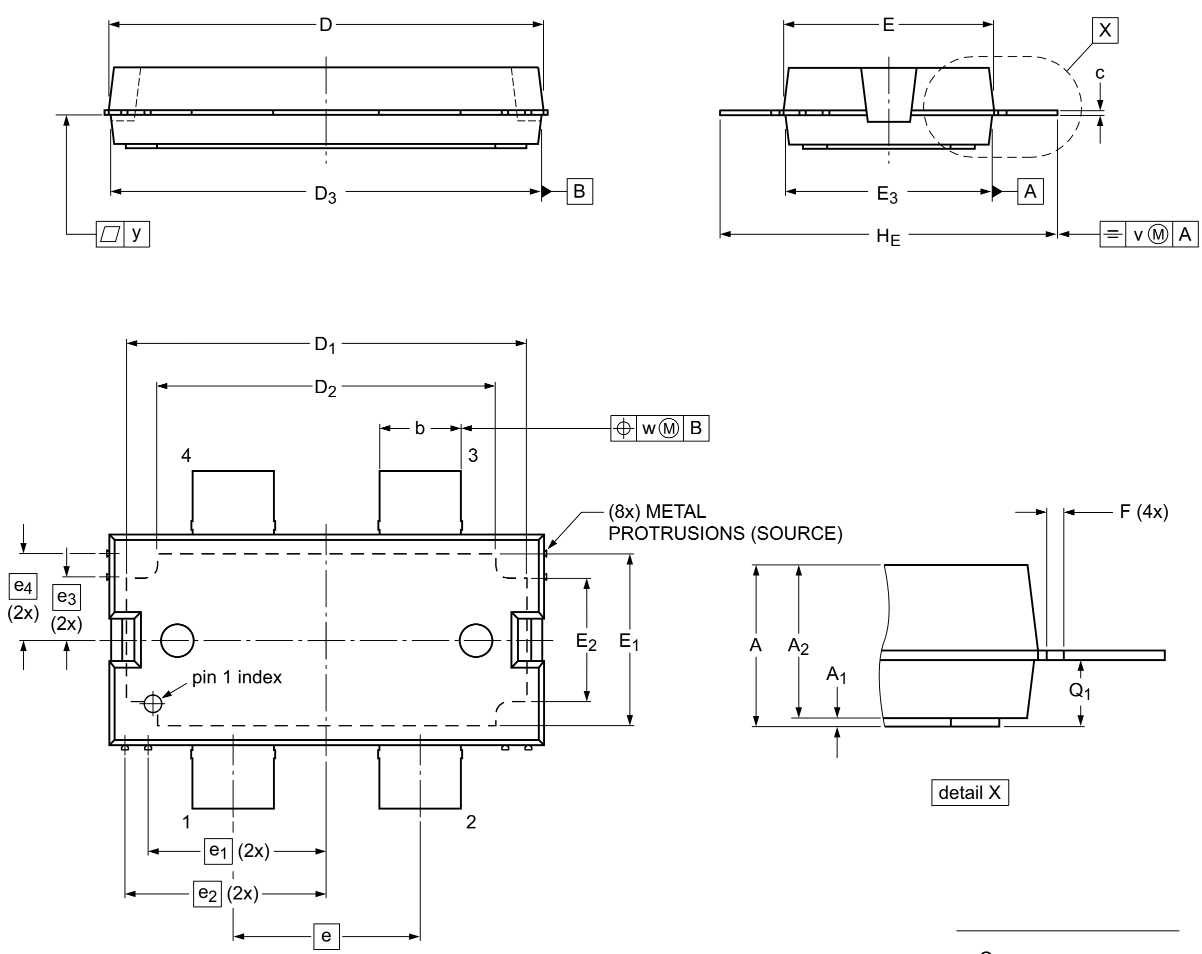
(6) V_{DS} = 25 V

(7) V_{DS} = 20 V

Fig 11. Drain efficiency as a function of output power; typical values

8. Package outline

HSOP4F: plastic, heatsink small outline package; 4 leads(flat) **SOT1223-2**



Q1	v	w	y
1.62			0.1
1.57	0.25	0.25	
1.52			

0 — 10 mm
scale

Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	b	c	D(1)	D_1	D_2	D_3	E(1)	E_1	E_2	E_3	e	e_1	e_2	e_3	e_4	F	H_E
	max	3.9	0.2	3.65	3.90	0.27	20.62	19.00	16.05	20.44	10.01	8.18	5.89	9.83							16.16
mm	nom		0.1	3.60	3.85	0.22	20.57	18.95	16.00	20.39	9.96	8.13	5.84	9.78	8.85	8.45	9.55	2.97	4.07	0.4	15.96
	min		0	3.55	3.80	0.17	20.52	18.90	15.95	20.34	9.91	8.08	5.79	9.73							15.76

Note
1. Package body dimensions “D and “E do not include mold and metal protrusions. Allowable protrusion is 0.25 mm per side.
2. Lead width dimension “b does not include dambar protrusions. Allowable dambar protrusion is 0.25 mm in total per lead.

sot1223-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1223-2						~~15-01-12~~ 15-06-04

Fig 12. Package outline SOT1223-2 (HSOP4F)

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.

10. Abbreviations

Table 12. Abbreviations

Acronym	Description
CW	Continuous Wave
DVB-T	Digital Video Broadcast - Terrestrial
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
SMD	Surface Mounted Device
UIS	Unclamped Inductive Switching
VSWR	Voltage Standing-Wave Ratio

11. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLP05H6150XR v.3	20160108	Product data sheet	-	BLP05H6150XR#2
Modifications	• Table 1 on page 1: table updated • Section 1.2 on page 1: table updated • Table 5 on page 2: table updated • Figure 1 on page 3: figure added • Table 8 on page 4: table updated • Figure 2 on page 4: figure added • Figure 3 on page 5: figure updated • Table 9 on page 5: table updated • Table 10 on page 5: table updated • Figure 4 on page 5: figure added • Section 7.4 on page 6: section added • Section 7.5 on page 7: section added			
BLP05H6150XR#2	20150901	Objective data sheet	-	BLP05H6150XR v.1
BLP05H6150XR v.1	20150518	Objective 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.

12.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Ampleon does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Ampleon sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Ampleon and its customer, unless Ampleon and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Ampleon product is deemed to offer functions and qualities beyond those described in the Product data sheet.

12.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Ampleon does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Ampleon takes no responsibility for the content in this document if provided by an information source outside of Ampleon.

In no event shall Ampleon be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Ampleon's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of Ampleon.

Right to make changes — Ampleon reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Ampleon products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Ampleon product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Ampleon and its suppliers accept no liability for inclusion and/or use of Ampleon products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Ampleon makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Ampleon products, and Ampleon accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Ampleon product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Ampleon does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Ampleon products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Ampleon does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Ampleon products are sold subject to the general terms and conditions of commercial sale, as published at http://www.ampleon.com/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Ampleon hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Ampleon products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Ampleon product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Ampleon accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Ampleon' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Ampleon' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Ampleon for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Ampleon' standard warranty and Ampleon' product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

12.4 Licenses

ICs with DVB-T or DVB-T2 functionality
Use of this product in any manner that complies with the DVB-T or the DVB-T2 standard may require licenses under applicable patents of the DVB-T respectively the DVB-T2 patent portfolio, which license is available from Sisvel S.p.A., Via Sestriere 100, 10060 None (TO), Italy, and under applicable patents of other parties.

12.5 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Any reference or use of any 'NXP' trademark in this document or in or on the surface of Ampleon products does not result in any claim, liability or entitlement vis-à-vis the owner of this trademark. Ampleon is no longer part of the NXP group of companies and any reference to or use of the 'NXP' trademarks will be replaced by reference to or use of Ampleon's own trademarks.

13. Contact information

For more information, please visit: **http://www.ampleon.com**

For sales office addresses, please visit: **http://www.ampleon.com/sales**

14. Contents

For more information, please visit: http://www.ampleon.com
For sales office addresses, please visit: http://www.ampleon.com/sales

Date of release: 8 January 2016
Document identifier: BLP05H6150XR