

BLP05H6110XR

Power LDMOS transistor

Rev. 3 — 3 February 2016

AMMPELON

Product data sheet

1. Product profile

1.1 General description

A 110 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
	(MHz)	(V)	(W)	(dB)	(%)
pulsed RF	108	50	110	27	75

1.2 Features and benefits

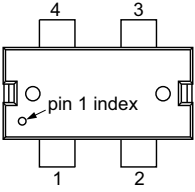
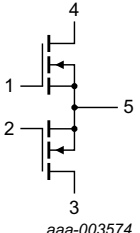
- Easy power control
- Integrated double sided ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

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		
2	gate 1		
3	drain 1		
4	drain 2		
5	source		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLP05H6110XR	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

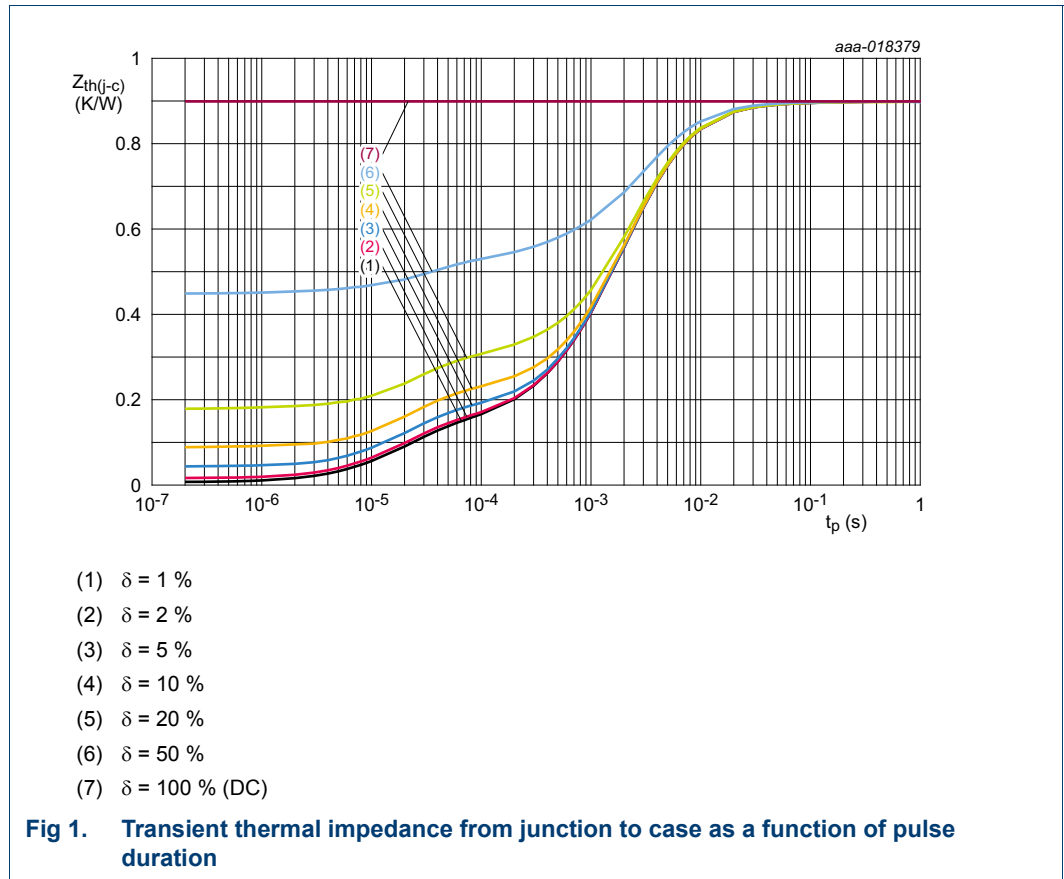
Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_j = 125\text{ °C}$ [1][2]	0.9	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	$T_j = 150\text{ °C}$; $t_p = 100\text{ }\mu\text{s}$; $\delta = 20\text{ %}$ [3]	0.31	K/W

[1] T_j is the junction temperature.

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

[3] See Figure 1.



6. Characteristics

Table 6. DC characteristics

$T_j = 25 \text{ }^{\circ}\text{C}$; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0 \text{ V}$; $I_D = 0.375 \text{ mA}$	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10 \text{ V}$; $I_D = 37.5 \text{ mA}$	1.25	1.8	2.25	V
V_{GSq}	gate-source quiescent voltage	$V_{DS} = 50 \text{ V}$; $I_D = 10 \text{ mA}$	-	1.7	-	V
I_{DSS}	drain leakage current	$V_{GS} = 0 \text{ V}$; $V_{DS} = 50 \text{ V}$	-	-	1.4	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75 \text{ V}$; $V_{DS} = 10 \text{ V}$	-	5.4	-	A
I_{GSS}	gate leakage current	$V_{GS} = 11 \text{ V}$; $V_{DS} = 0 \text{ V}$	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75 \text{ V}$; $I_D = 1.31 \text{ A}$	-	1.1	-	Ω

Table 7. AC characteristics

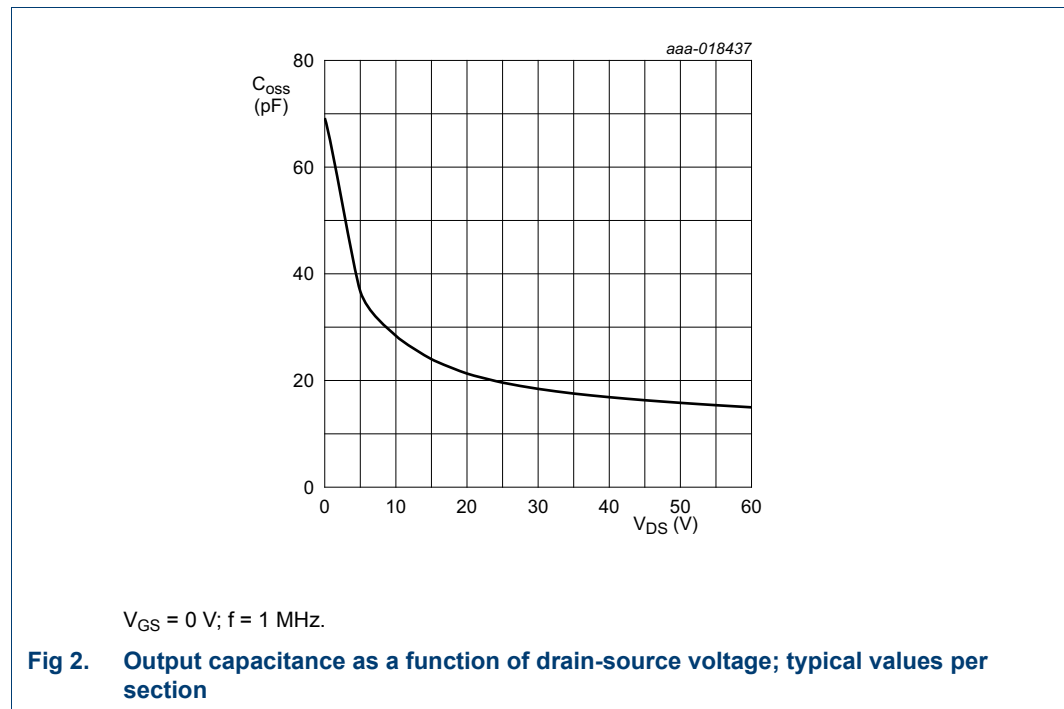
$T_j = 25\text{ }^{\circ}\text{C}$; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{rs}	feedback capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$; $f = 1\text{ MHz}$	-	0.4	-	pF
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$; $f = 1\text{ MHz}$	-	46	-	pF
C_{oss}	output capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$; $f = 1\text{ MHz}$	-	17	-	pF

Table 8. RF characteristics

Test signal: pulsed RF; $t_p = 100\text{ }\mu\text{s}$; $\delta = 20\%$; $f = 108\text{ MHz}$; RF performance at $V_{DS} = 50\text{ V}$; $I_{Dq} = 20\text{ mA}$; $T_{case} = 25\text{ }^{\circ}\text{C}$; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	$P_L = 110\text{ W}$	25.5	27	-	dB
RL_{in}	input return loss	$P_L = 110\text{ W}$	-	-9	-	dB
η_D	drain efficiency	$P_L = 110\text{ W}$	72	75	-	%



7. Test information

7.1 Ruggedness in class-AB operation

The BLP05H6110XR is capable of withstanding a load mismatch corresponding to $VSWR > 65 : 1$ through all phases under the following conditions: $V_{DS} = 50\text{ V}$; $I_{Dq} = 20\text{ mA}$; $P_L = 110\text{ W}$ pulsed; $f = 108\text{ MHz}$.

7.2 Impedance information

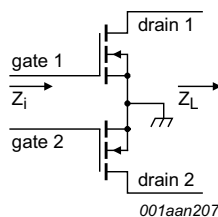


Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at $V_{DS} = 50\text{ V}$ and $P_L = 110\text{ W}$.

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
108	$42 - j116$	$34 + j8.1$

7.3 UIS avalanche energy

Table 10. Typical avalanche data per section

$T_{amb} = 25\text{ }^\circ\text{C}$; typical test data; test jig without water cooling.

I_{AS}	E_{AS}
(A)	(J)
3	0.27
3.8	0.17
4.5	0.13

For information see application note AN10273.

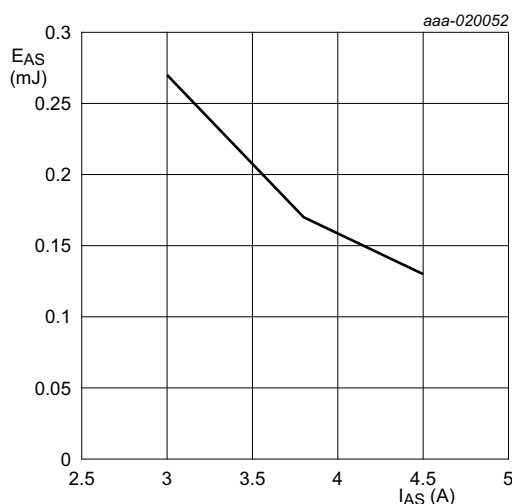


Fig 4. Non-repetitive avalanche energy as a function of single pulse avalanche current; typical values

7.4 Test circuit

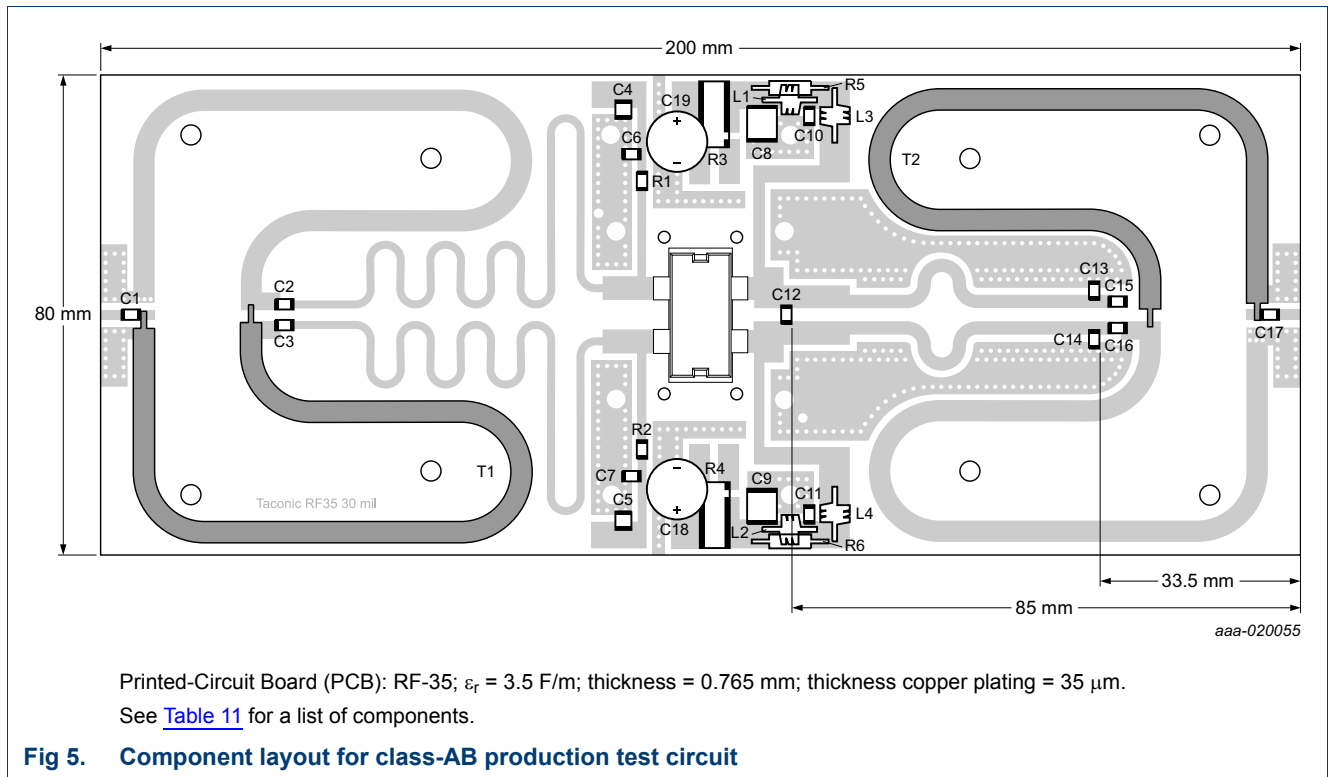


Table 11. List of components

For test circuit see [Figure 5](#).

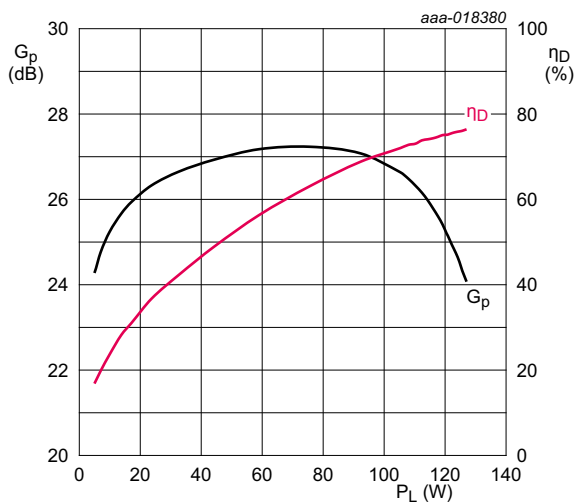
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	100 pF	[1]
C2, C3	multilayer ceramic chip capacitor	1 nF	[1]
C4, C5	multilayer ceramic chip capacitor	4.7 μ F, 50 V	Kemet: C1210X475K5RAC-T4
C6, C7	multilayer ceramic chip capacitor	750 pF	[1]
C8, C9	multilayer ceramic chip capacitor	4.7 μ F, 100 V	TDK: C5750X7R2A475KT
C10, C11	multilayer ceramic chip capacitor	750 pF	[1]
C12	multilayer ceramic chip capacitor	13 pF	[1]
C13, C14	multilayer ceramic chip capacitor	27 pF	[1]
C15, C16	multilayer ceramic chip capacitor	1 nF	[1]
C17	multilayer ceramic chip capacitor	47 pF	[1]
C18, C19	electrolytic capacitor	2200 μ F, 64 V	
L1, L2	wire inductor	5 turns, D = 3 mm, 1 mm copper wire	
L3, L4	wire inductor	8 turns, D = 3 mm, 1 mm copper wire	
R1, R2	resistor	4.7 k Ω	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

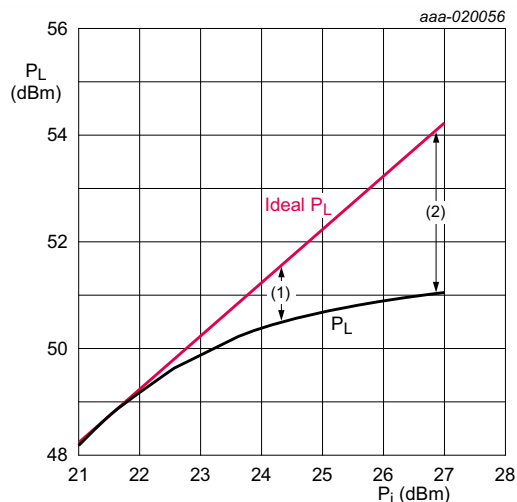
The following figures are measured in a class-AB production test circuit.

7.5.1 1-Tone CW pulsed



$V_{DS} = 50$ V; $I_{DQ} = 40$ mA; $f = 108$ MHz; $t_p = 100$ μ s;
 $\delta = 20$ %.

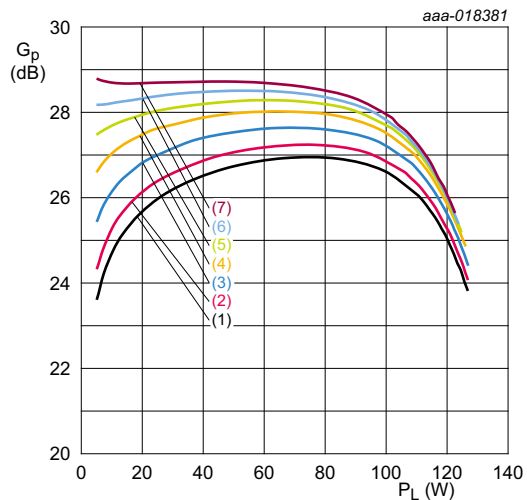
Fig 6. Power gain and drain efficiency as function of output power; typical values



$V_{DS} = 50$ V; $I_{DQ} = 40$ mA; $f = 108$ MHz; $t_p = 100$ μ s;
 $\delta = 20$ %.

- (1) $P_{L(1dB)} = 50.5$ dBm (111 W)
- (2) $P_{L(3dB)} = 51.0$ dBm (126 W)

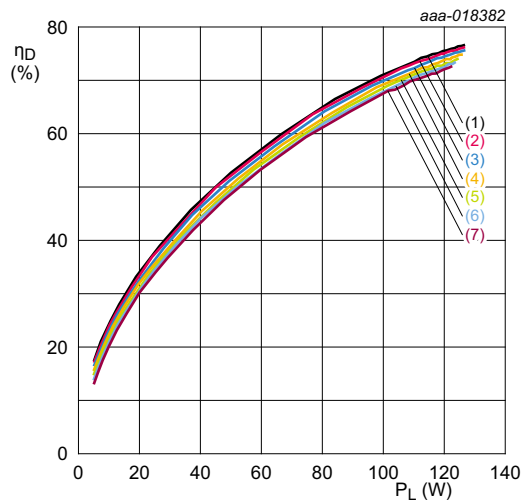
Fig 7. Output power as a function of input power; typical values



$V_{DS} = 50 \text{ V}$; $f = 108 \text{ MHz}$; $t_p = 100 \text{ } \mu\text{s}$; $\delta = 20 \text{ } \%$.

- (1) $I_{DQ} = 20 \text{ mA}$
- (2) $I_{DQ} = 40 \text{ mA}$
- (3) $I_{DQ} = 100 \text{ mA}$
- (4) $I_{DQ} = 200 \text{ mA}$
- (5) $I_{DQ} = 300 \text{ mA}$
- (6) $I_{DQ} = 400 \text{ mA}$
- (7) $I_{DQ} = 500 \text{ mA}$

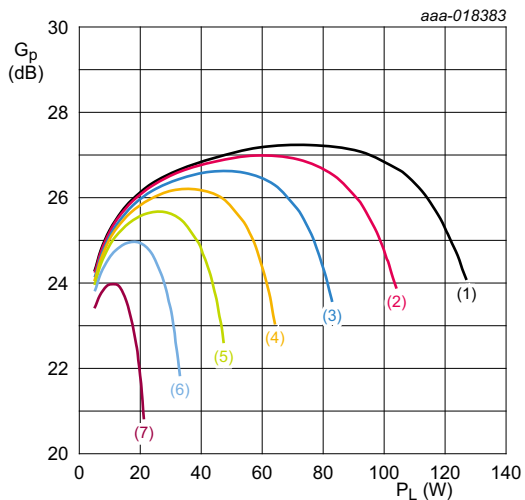
Fig 8. Power gain as a function of output power; typical values



$V_{DS} = 50 \text{ V}$; $f = 108 \text{ MHz}$; $t_p = 100 \text{ } \mu\text{s}$; $\delta = 20 \text{ } \%$.

- (1) $I_{DQ} = 20 \text{ mA}$
- (2) $I_{DQ} = 40 \text{ mA}$
- (3) $I_{DQ} = 100 \text{ mA}$
- (4) $I_{DQ} = 200 \text{ mA}$
- (5) $I_{DQ} = 300 \text{ mA}$
- (6) $I_{DQ} = 400 \text{ mA}$
- (7) $I_{DQ} = 500 \text{ mA}$

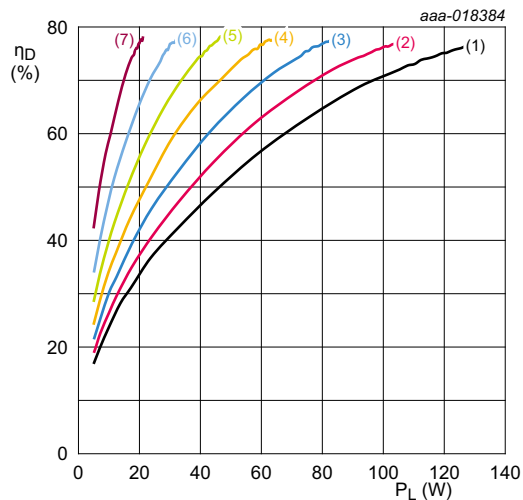
Fig 9. Drain efficiency as a function of output power; typical values



$I_{DQ} = 40 \text{ mA}$; $f = 108 \text{ MHz}$; $t_p = 100 \text{ } \mu\text{s}$; $\delta = 20 \text{ } \%$.

- (1) $V_{DS} = 50 \text{ V}$
- (2) $V_{DS} = 45 \text{ V}$
- (3) $V_{DS} = 40 \text{ V}$
- (4) $V_{DS} = 35 \text{ V}$
- (5) $V_{DS} = 30 \text{ V}$
- (6) $V_{DS} = 25 \text{ V}$
- (7) $V_{DS} = 20 \text{ V}$

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



$I_{DQ} = 40 \text{ mA}$; $f = 108 \text{ MHz}$; $t_p = 100 \text{ } \mu\text{s}$; $\delta = 20 \text{ } \%$.

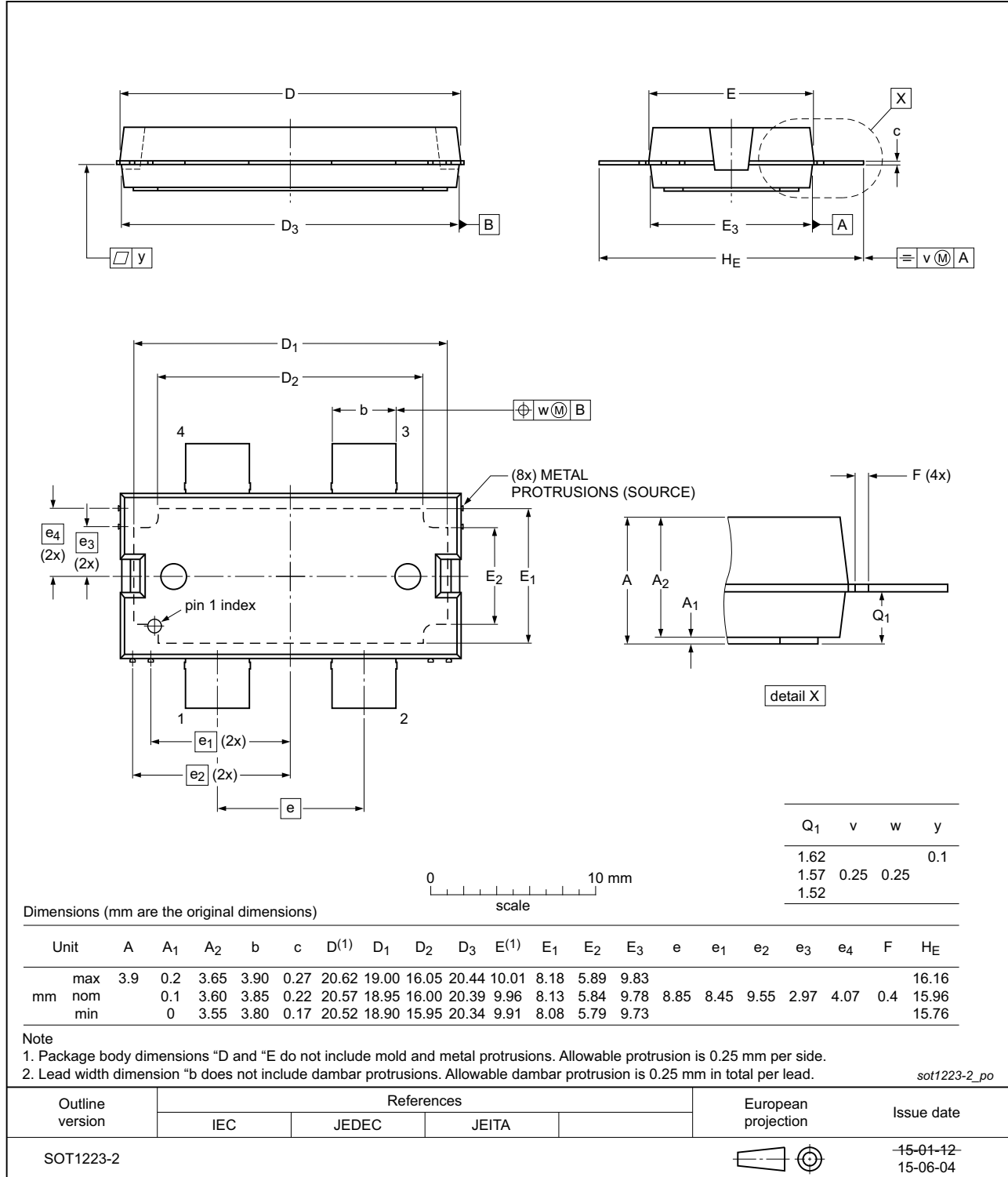
- (1) $V_{DS} = 50 \text{ V}$
- (2) $V_{DS} = 45 \text{ V}$
- (3) $V_{DS} = 40 \text{ V}$
- (4) $V_{DS} = 35 \text{ V}$
- (5) $V_{DS} = 30 \text{ V}$
- (6) $V_{DS} = 25 \text{ V}$
- (7) $V_{DS} = 20 \text{ V}$

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



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
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
BLP05H6110XR v.3	20160203	Product data sheet	-	BLP05H6110XR#2
Modifications	• Section 1.2 on page 1: section 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			
BLP05H6110XR#2	20150901	Objective data sheet	-	BLP05H6110XR v.1
BLP05H6110XR 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".

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