

BLP05H6250XR; BLP05H6250XRG

Power LDMOS transistor

Rev. 4 — 21 September 2016

AMPLEON

Product data sheet

1. Product profile

1.1 General description

A 250 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 (MHz)	V _{DS} (V)	P _L (W)	G _p (dB)	η _D (%)
pulsed RF	108	50	250	27	75

1.2 Features and benefits

- Easy power control
- Integrated dual sided ESD protection enables class C operation and complete switch off of the transistor
- 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
BLP05H6250XR (SOT1223-2)			
1	gate 2		 aaa-003574
2	gate 1		
3	drain 1		
4	drain 2		
5	source ^[1]		
BLP05H6250XRG (SOT1224-2)			
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
BLP05H6250XR	HSOP4F	plastic, heatsink small outline package; 4 leads (flat)	SOT1223-2
BLP05H6250XRG	HSOP4F	plastic, heatsink small outline package; 4 leads	SOT1224-2

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

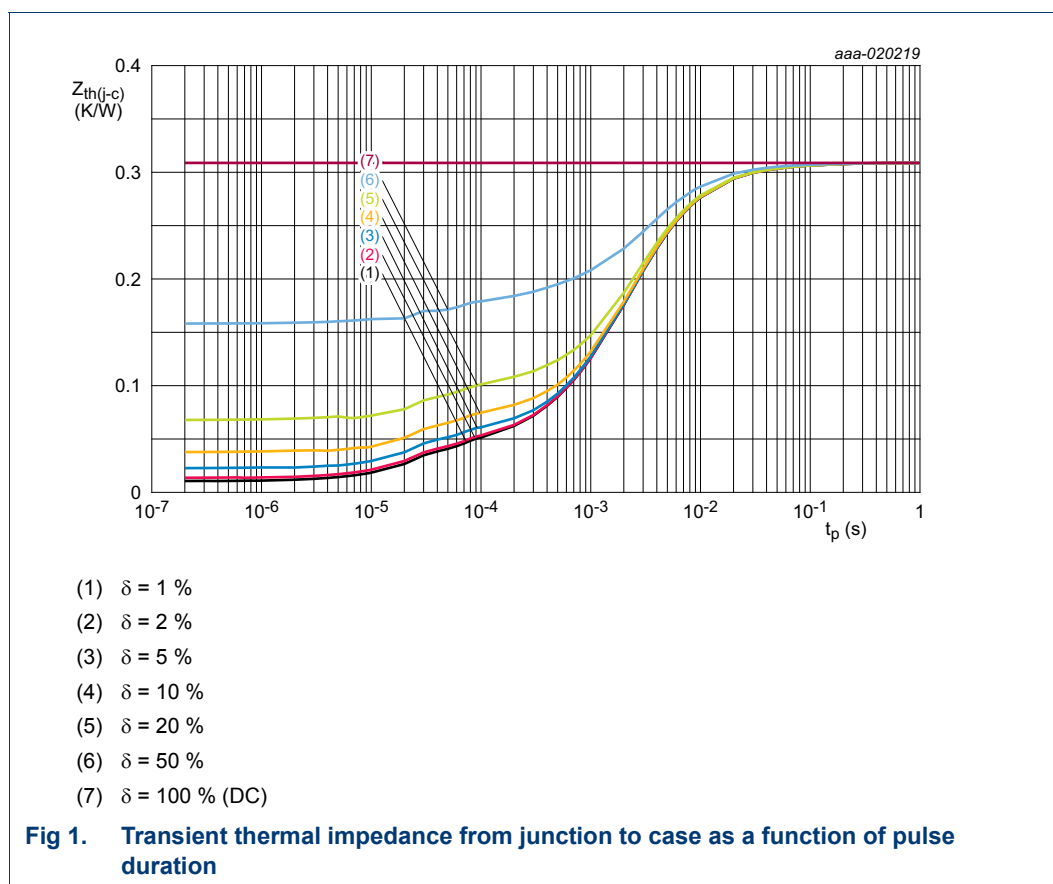
[1] Continuous use at maximum temperature will affect the reliability, for details refer to the online MTF calculator.

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	$T_j = 115\text{ °C}$ [1][2]	0.31	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	$T_j = 150\text{ °C}; t_p = 100\text{ }\mu\text{s}; \delta = 20\%$ [3]	0.101	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

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 1.0\text{ mA}$	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$V_{DS} = 10\text{ V}; I_D = 100\text{ mA}$	1.33	1.9	2.33	V
V_{GSq}	gate-source quiescent voltage	$V_{DS} = 50\text{ V}; I_D = 50\text{ mA}$	-	1.8	-	V

Table 6. DC characteristics ...continued
 $T_j = 25\text{ }^\circ\text{C}$; per section unless otherwise specified.

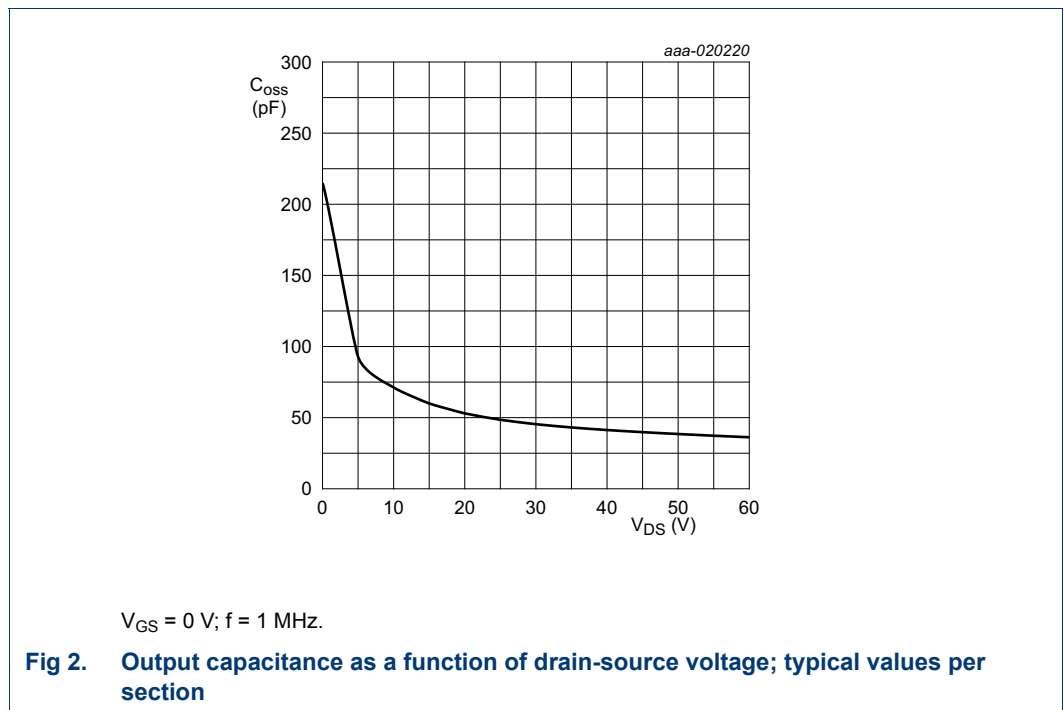
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DSS}	drain leakage current	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}$	-	-	1.4	μA
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; V_{DS} = 10\text{ V}$	-	14.6	-	A
I_{GSS}	gate leakage current	$V_{GS} = 11\text{ V}; V_{DS} = 0\text{ V}$	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75\text{ V}; I_D = 3.5\text{ A}$	-	0.40	-	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	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	-	0.9	-	pF
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	-	120	-	pF
C_{oss}	output capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 50\text{ V}; f = 1\text{ MHz}$	-	39	-	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 $V_{DS} = 50\text{ V}$; $I_{Dq} = 100\text{ mA}$; $T_{case} = 25\text{ }^\circ\text{C}$; unless otherwise specified; in a class-AB production test circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	$P_L = 250\text{ W}$	26.2	27	-	dB
RL_{in}	input return loss	$P_L = 250\text{ W}$	-	-12	-10	dB
η_D	drain efficiency	$P_L = 250\text{ W}$	72	75	-	%



7. Test information

7.1 Ruggedness in class-AB operation

The BLP05H6250XR and BLP05H6250XRG are capable of withstanding a load mismatch corresponding to VSWR > 65 : 1 through all phases under the following conditions: $V_{DS} = 50\text{ V}$; $I_{DQ} = 100\text{ mA}$; $P_L = 250\text{ W}$ pulsed; $f = 108\text{ MHz}$.

7.2 Impedance information

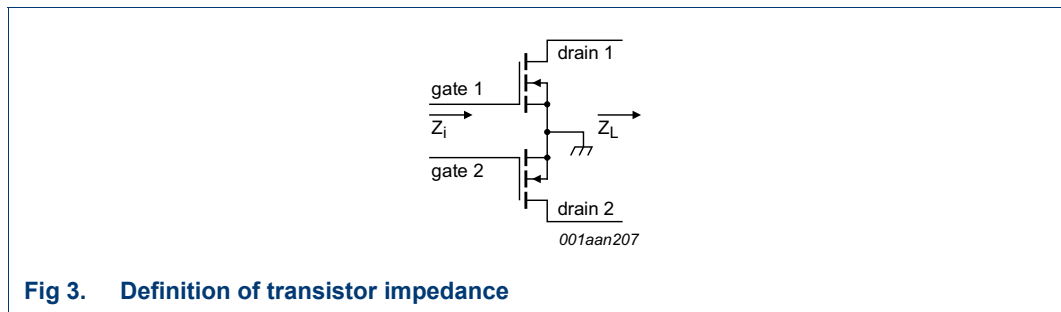


Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at $V_{DS} = 50\text{ V}$ and $P_L = 250\text{ W}$.

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
108	15.9 – 49.8j	15.3 + 3.5j

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)
8	1.4
9	1.0
10	0.8

For information see application note AN10273.

7.4 Test circuit

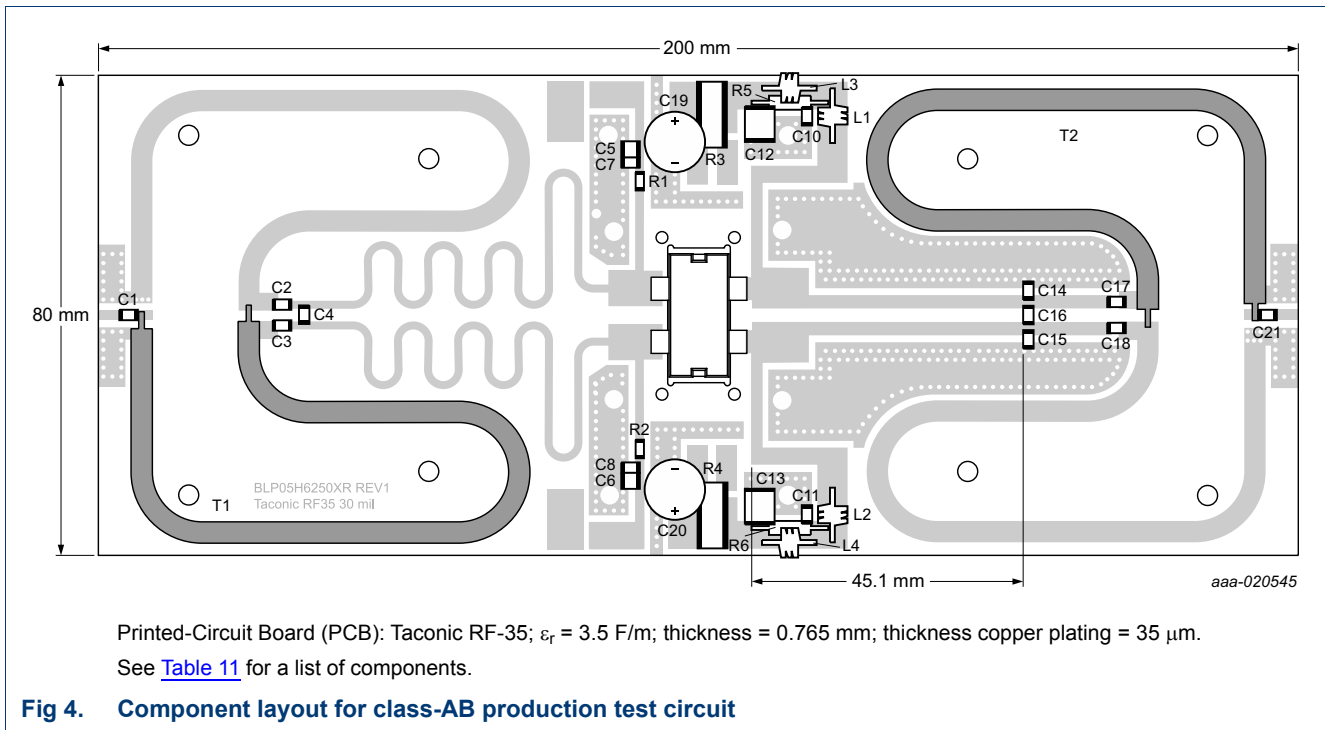


Table 11. List of components

For test circuit see [Figure 4](#).

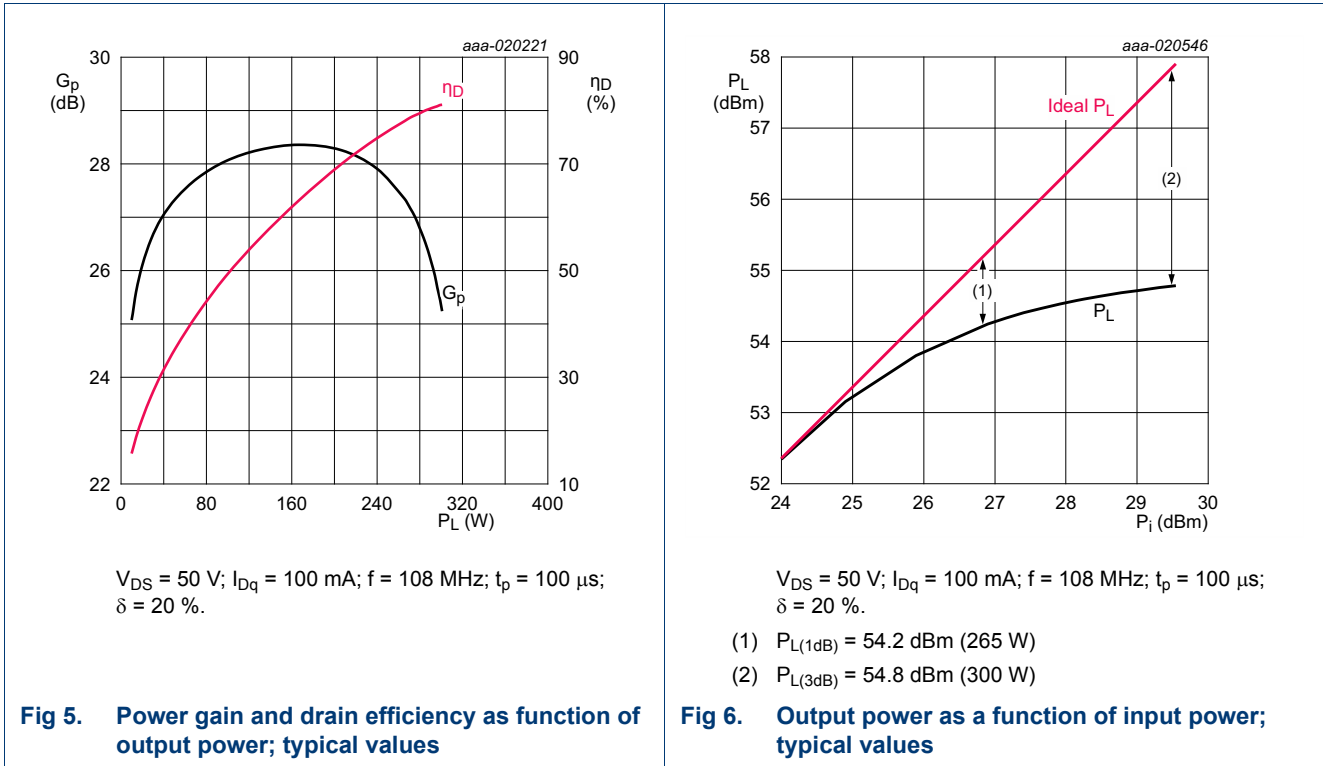
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	510 pF	[1]
C2, C3	multilayer ceramic chip capacitor	220 pF	[1]
C4	multilayer ceramic chip capacitor	91 pF	[1]
C5, C6	multilayer ceramic chip capacitor	4.7 μ F, 50 V	
C7, C8	multilayer ceramic chip capacitor	820 pF	[1]
C10, C11	multilayer ceramic chip capacitor	820 pF	[1]
C12, C13	multilayer ceramic chip capacitor	4.7 μ F, 100 V	
C14, C15	multilayer ceramic chip capacitor	43 pF	[1]
C16	multilayer ceramic chip capacitor	6.8 pF	[1]
C17, C18	multilayer ceramic chip capacitor	120 pF	[1]
C19, C20	electrolytic capacitor	2200 μ F, 64 V	
C21	multilayer ceramic chip capacitor	62 pF	[1]
L1, L2	wire inductor	10 turns, D = 2 mm, 0.5 mm copper wire	
L3, L4	wire inductor	6 turns, D = 2 mm, 0.5 mm copper wire	
R1, R2	resistor	4.7 k Ω	SMD 1206
R3, R4	shunt resistor	0.01 Ω	FC4L110R010FER
R5, R6	metal film resistor	10 Ω , 0.6 W	
T1, T2	semi rigid coax	50 Ω , length = 160 mm	EZ-141-AL-TP-M17

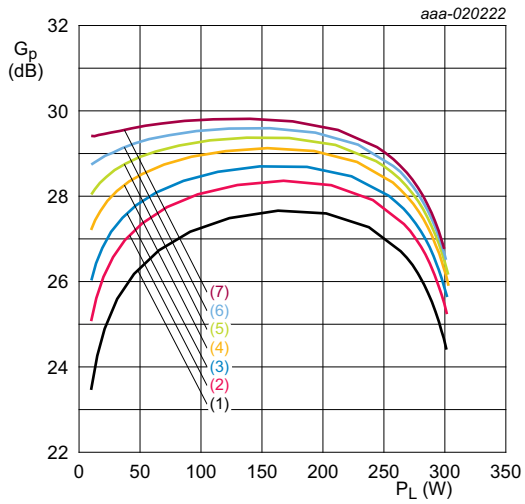
[1] American Technical Ceramics type 100B or capacitor of same quality.

7.5 Graphical data

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

7.5.1 1-Tone CW pulsed

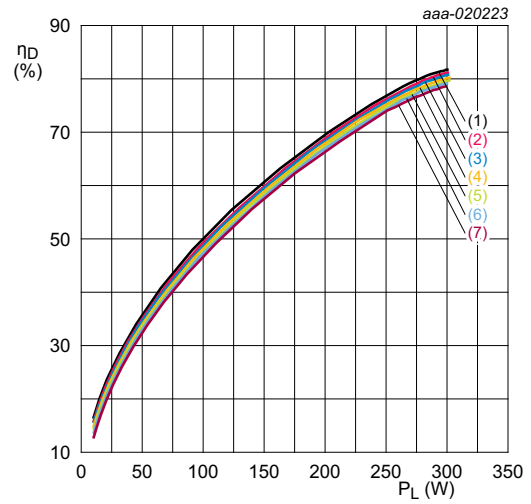




$V_{DS} = 50 \text{ V}; f = 108 \text{ MHz}; t_p = 100 \text{ } \mu\text{s}; \delta = 20 \text{ \%}.$

- (1) $I_{Dq} = 20 \text{ mA}$
- (2) $I_{Dq} = 100 \text{ mA}$
- (3) $I_{Dq} = 200 \text{ mA}$
- (4) $I_{Dq} = 400 \text{ mA}$
- (5) $I_{Dq} = 600 \text{ mA}$
- (6) $I_{Dq} = 800 \text{ mA}$
- (7) $I_{Dq} = 1000 \text{ mA}$

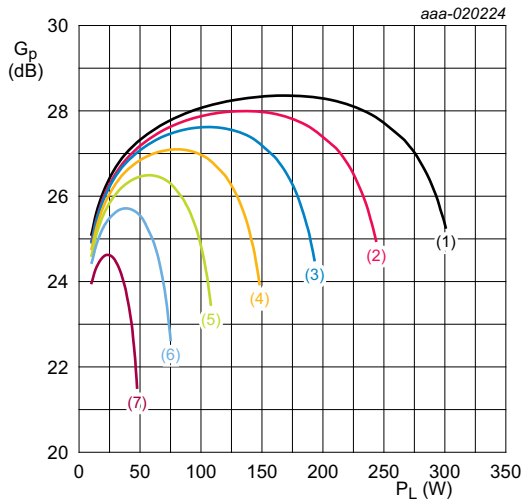
Fig 7. Power gain as a function of output power; typical values



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

- (1) $I_{Dq} = 20 \text{ mA}$
- (2) $I_{Dq} = 100 \text{ mA}$
- (3) $I_{Dq} = 200 \text{ mA}$
- (4) $I_{Dq} = 400 \text{ mA}$
- (5) $I_{Dq} = 600 \text{ mA}$
- (6) $I_{Dq} = 800 \text{ mA}$
- (7) $I_{Dq} = 1000 \text{ mA}$

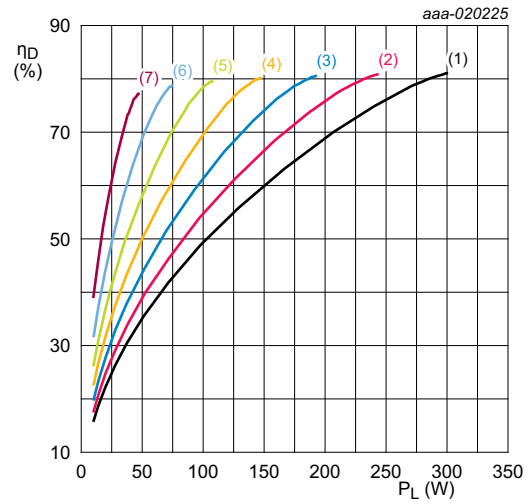
Fig 8. Drain efficiency as a function of output power; typical values



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

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



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

- (1) $V_{DS} = 50 \text{ V}$
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- (5) $V_{DS} = 30 \text{ V}$
- (6) $V_{DS} = 25 \text{ V}$
- (7) $V_{DS} = 20 \text{ V}$

Fig 10. Drain efficiency as a function of output power; typical values

8. Package outline

HSOP4F: plastic, heatsink small outline package; 4 leads(flat)

SOT1223-2

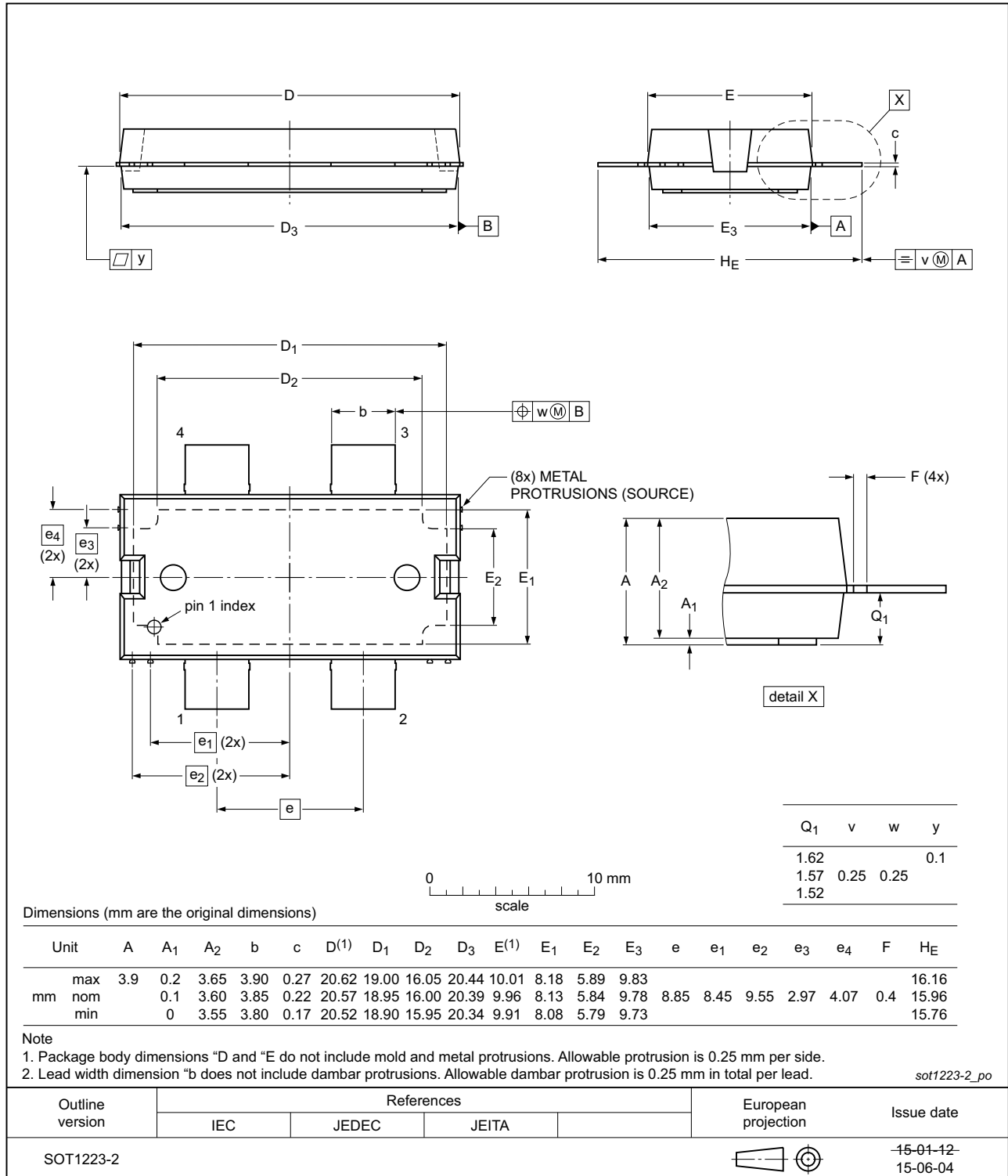


Fig 11. Package outline SOT1223-2 (HSOP4F)

HSOP4: plastic, heatsink small outline package; 4 leads

SOT1224-2

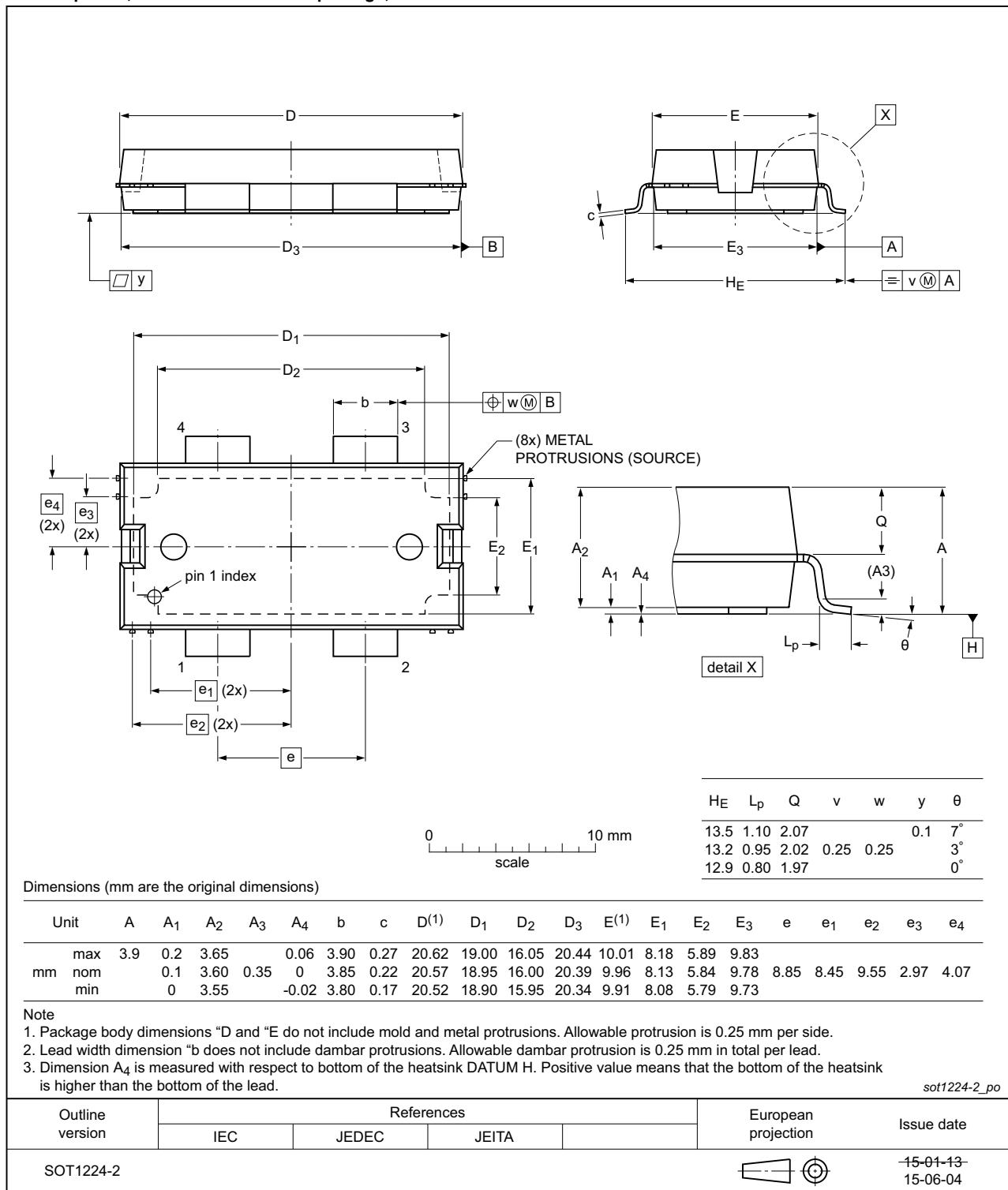


Fig 12. Package outline SOT1224-2 (HSOP4F)

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
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
BLP05H6250XR_H6250XRG v.4	20160921	Product data sheet	-	BLP05H6250XR v.3
Modifications:	<ul style="list-style-type: none"> The document now describes both the straight lead and gull-wing versions of this product: BLP05H6250XR and BLP05H6250XRG respectively Table 2 on page 2: added BLP05H6250XRG data Table 3 on page 2: added BLP05H6250XRG data Section 7.1 on page 5: added BLP05H6250XRG Figure 12 on page 11: added figure SOT1224-2 			
BLP05H6250XR v.3	20160203	Product data sheet	-	BLP05H6200XR#2
BLP05H6200XR#2	20150901	Objective data sheet	-	BLP05H6200XR v.1
BLP05H6200XR v.1	20150518	Objective data sheet	-	-

12. Legal information

12.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
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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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