BLP05H6700XR; BLP05H6700XRG

Power LDMOS transistor

Rev. 2 — 13 September 2018

AMPLEON

Product data sheet

1. Product profile

1.1 General description

A 700 W extra rugged LDMOS power transistor optimized for broadcast, industrial, aerospace and defense 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	700	26	75

1.2 Features and benefits

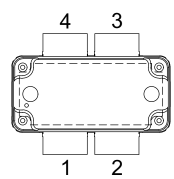
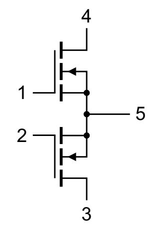
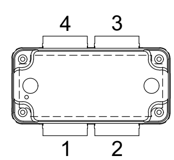
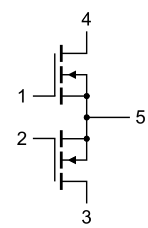
- Easy power control
- Integrated dual sided ESD protection enables class C operation and complete switch off of the transistor
- Excellent ruggedness VSWR 65 : 1
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- 50 V operation for easy broadband matching
- Package available in both straight leads and gull wing form
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

- Industrial, scientific and medical applications
- Broadcast transmitter applications
- Aerospace and defense applications

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLP05H6700XR (SOT1138-3)			
1	gate 2		 aaa-003574
2	gate 1		
3	drain 1		
4	drain 2		
5	source [1]		
BLP05H6700XRG (SOT1204-3)			
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
BLP05H6700XR	-	plastic, heatsink small outline package; 4 leads (flat)	SOT1138-3
BLP05H6700XRG	-	plastic, heatsink small outline package; 4 leads	SOT1204-3

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_{case}	case temperature		-	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

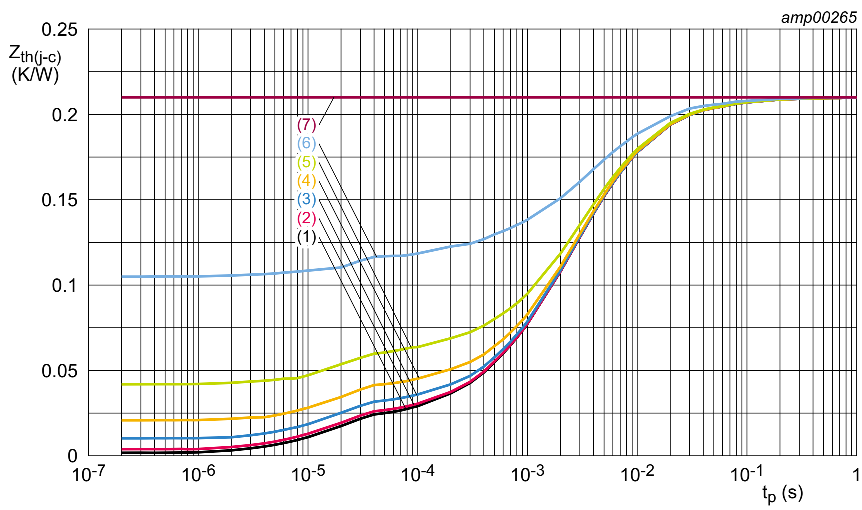
Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j\text{-}case)}$	thermal resistance from junction to case	T_j = 150 °C	[1][2]	0.21	K/W
$Z_{th(j\text{-}case)}$	transient thermal impedance from junction to case	T_j = 150 °C; t_p = 100 μs; δ = 20 %	[3]	0.064	K/W

[1] T_j is the junction temperature.

[2] $R_{th(j\text{-}c)}$ 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.

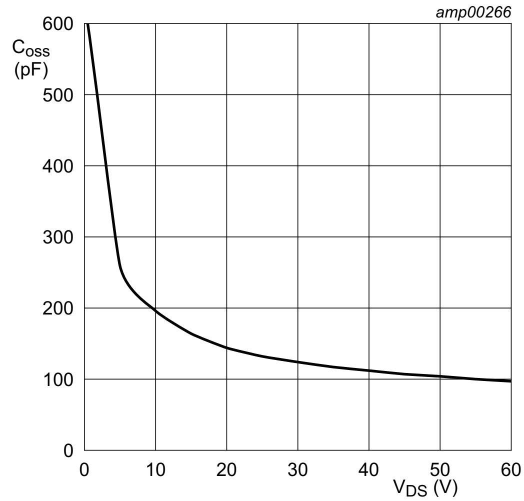
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 2.75 mA	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 275 mA	1.33	1.9	2.33	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 50 V; I_D = 50 mA	-	2.1	-	V
I_{DSS}	drain 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	-	36	-	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 = 9.625 A	-	0.16	-	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	-	2.75	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	297	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	104	-	pF

Table 8. RF characteristics
Test signal: pulsed RF; t_p = 100 μs; δ = 20 %; f = 108 MHz; RF performance at V_{DS} = 50 ; 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 = 700 W	25	26	-	dB
RL_{in}	input return loss	P_L = 700 W	-	−13	-	dB
η_D	drain efficiency	P_L = 700 W	72	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 BLP05H6700XR and the BLP05H6700XRG are capable of withstanding a load mismatch corresponding to VSWR > 65 : 1 through all phases under the following conditions: V_{DS} = 50 V; I_{Dq} = 100 mA; P_L = 700 W pulsed; f = 108 MHz.

7.2 Impedance information

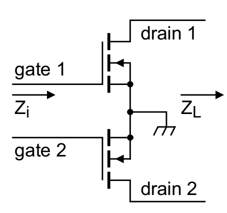


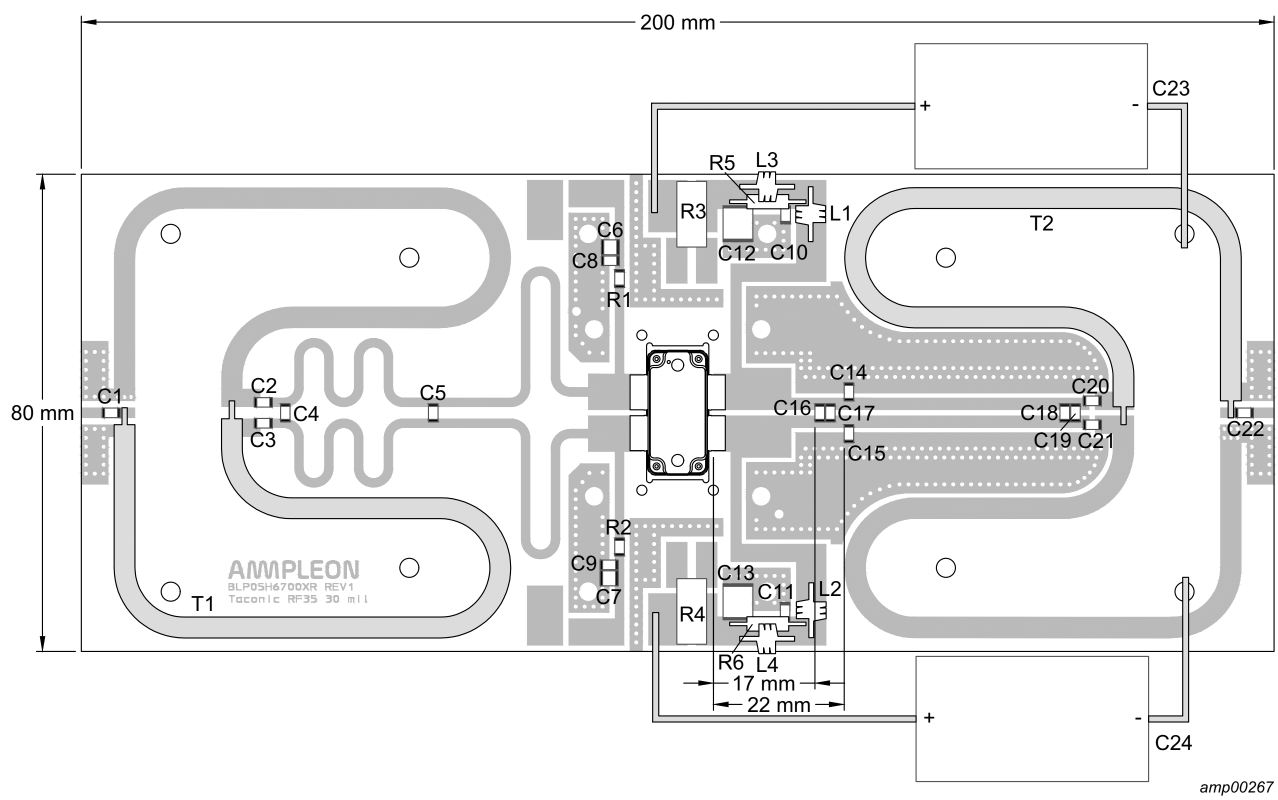
Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and P_L = 700 W.

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
108	5.9 – j19.1	5.5 + j1.1

7.3 Test circuit



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

See Table 10 for a list of components.

Fig 4. Component layout for class-AB production test circuit

Table 10. List of components

For test circuit see Figure 4.

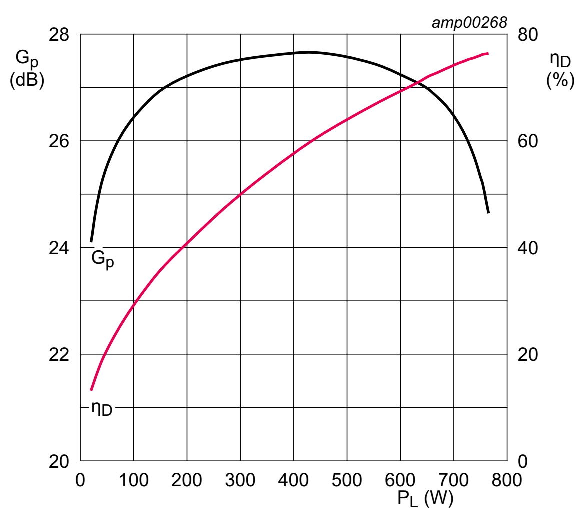
Component	Description	Value	Remarks
C1	multilayer ceramic chip capacitor	510 pF [1]	ATC 100B
C2, C3	multilayer ceramic chip capacitor	62 pF [1]	ATC 100B
C4	multilayer ceramic chip capacitor	20 pF [1]	ATC 100B
C5	multilayer ceramic chip capacitor	160 pF [1]	ATC 100B
C6, C7	multilayer ceramic chip capacitor	4.7 µF, 100 V	
C8, C9	multilayer ceramic chip capacitor	820 pF [1]	ATC 100B
C10, C11	multilayer ceramic chip capacitor	820pF [1]	ATC 100B
C12, C13	multilayer ceramic chip capacitor	4.7 µF, 100 V	
C14, C15	multilayer ceramic chip capacitor	91 pF [1]	ATC 100B
C16	multilayer ceramic chip capacitor	36 pF [1]	ATC 100B
C17	multilayer ceramic chip capacitor	22 pF [1]	ATC 100B
C18, C19	multilayer ceramic chip capacitor	47 pF [1]	ATC 100B
C20, C21	multilayer ceramic chip capacitor	120 pF [1]	ATC 100B

Table 10. List of components *...continued*
For test circuit see Figure 4.

Component	Description	Value	Remarks
C22	multilayer ceramic chip capacitor	220 pF [1]	ATC 100B
C23, C24	electrolytic capacitor	2200 μF, 64 V	
L1, L2	air inductor	10 turns, d = 2 mm	0.5 mm copper wire
L3, L4	air inductor	6 turns, d = 2 mm	0.5 mm copper wire
R1, R2	resistor	4.7 kΩ	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, 160 mm	EZ 86-TP/M17

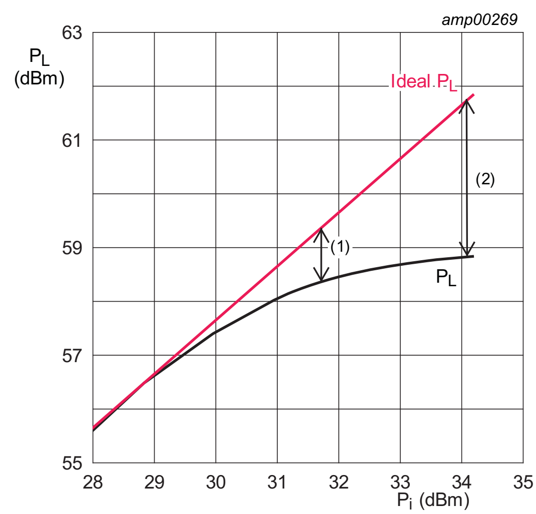
[1] American Technical Ceramics type 100B or capacitor of same quality.

7.4 Graphical data



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

Fig 5. Power gain and drain efficiency as function of output power; typical values

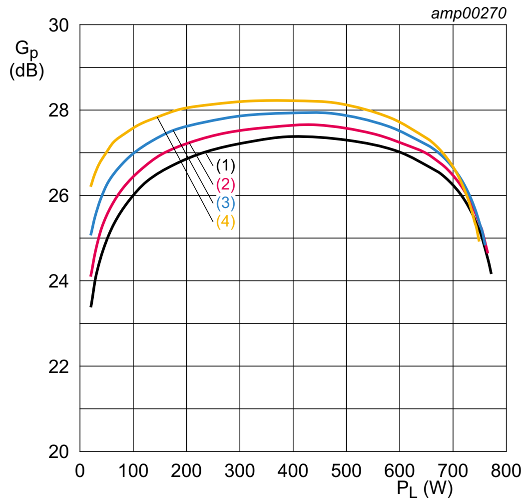


V_{DS} = 50 V; I_{Dq} = 100 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) $P_{L(1dB)}$ = 58.4 dBm (692 W)

(2) $P_{L(3dB)}$ = 58.8 dBm (765 W)

Fig 6. Output power as a function of input power; typical values



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

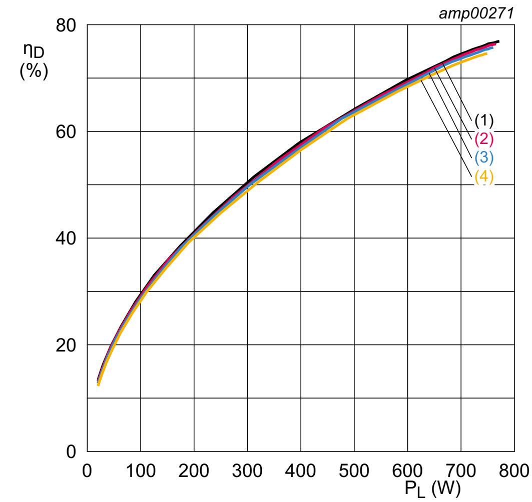
(1) I_{Dq} = 50 mA

(2) I_{Dq} = 100 mA

(3) I_{Dq} = 200 mA

(4) I_{Dq} = 400 mA

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



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

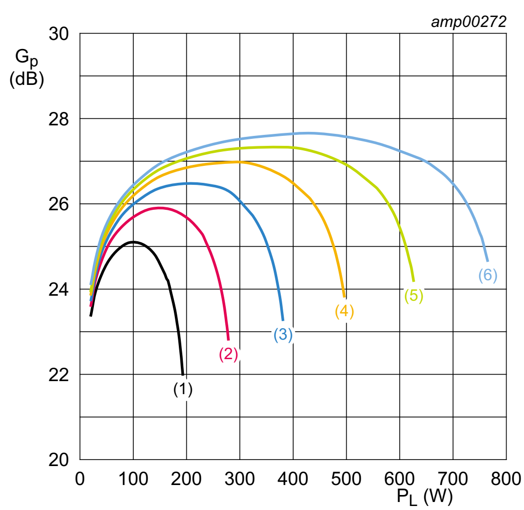
(1) I_{Dq} = 50 mA

(2) I_{Dq} = 100 mA

(3) I_{Dq} = 200 mA

(4) I_{Dq} = 400 mA

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



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

(1) V_{DS} = 25 V

(2) V_{DS} = 30 V

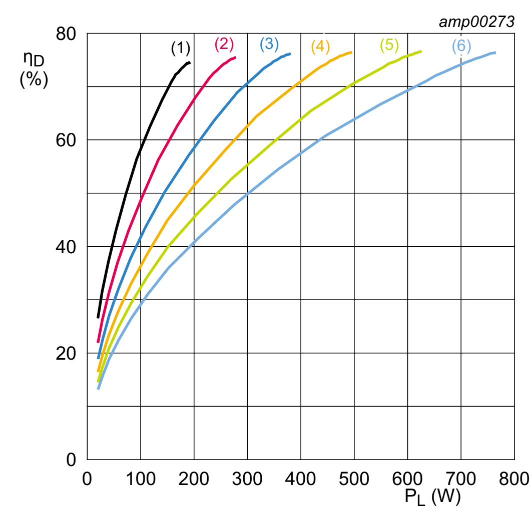
(3) V_{DS} = 35 V

(4) V_{DS} = 40 V

(5) V_{DS} = 45 V

(6) V_{DS} = 50 V

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



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

(1) V_{DS} = 25 V

(2) V_{DS} = 30 V

(3) V_{DS} = 35 V

(4) V_{DS} = 40 V

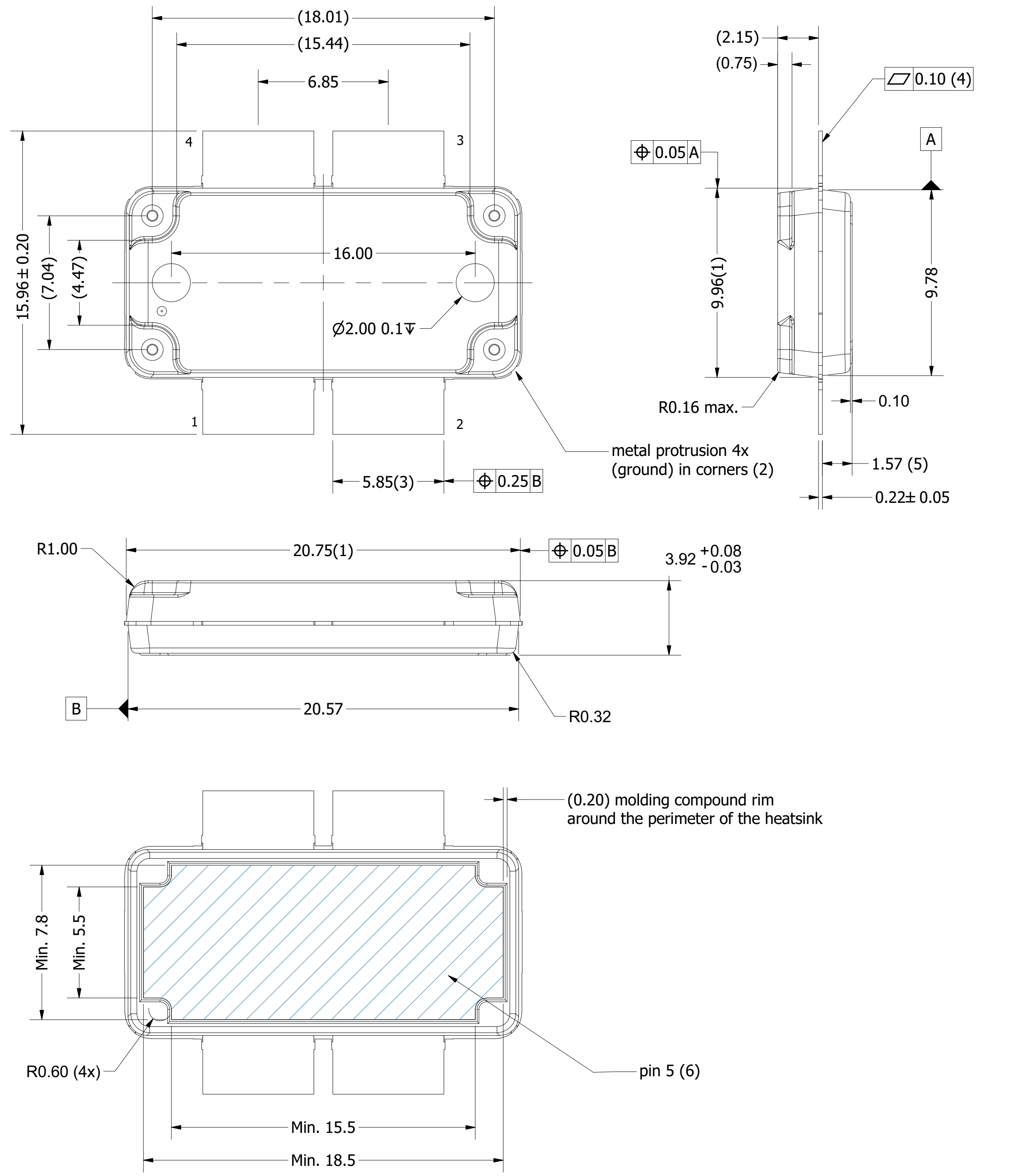
(5) V_{DS} = 45 V

(6) V_{DS} = 50 V

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

8. Package outline

SOT1138-3

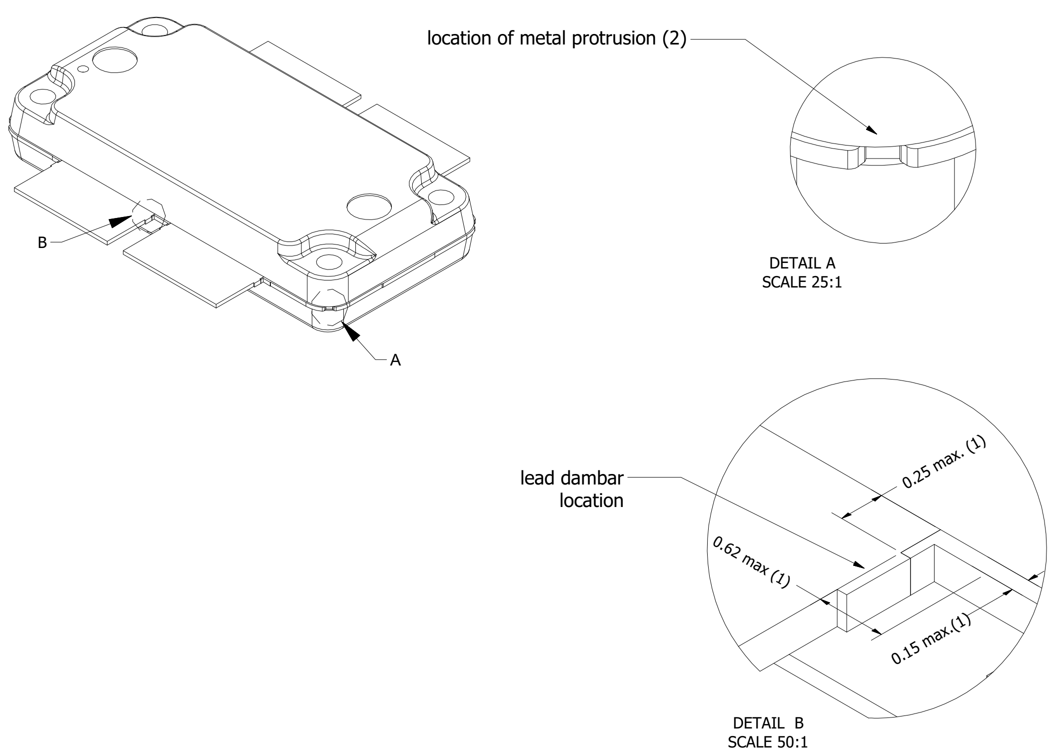


Package outline drawing: SOT1138-3	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 1 Revision date: 7/26/2018
		Third angle projection	Sheet 1 of 2

Fig 11. Package outline SOT1138-3 (sheet 1 of 2)

SOT1138-3

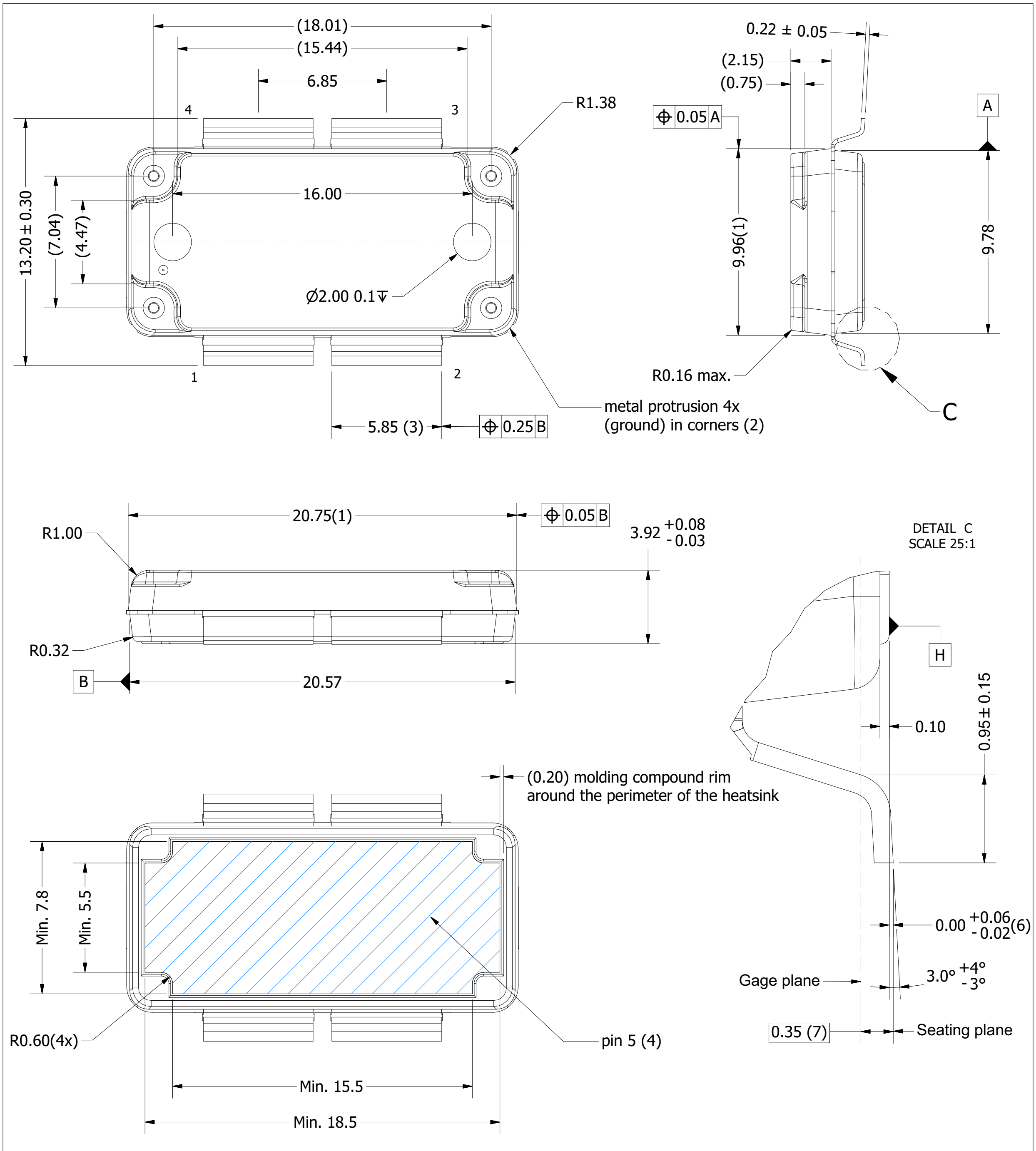
Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. All areas located adjacent to the leads have a maximum mold protrusion of 0.25 mm (per side) and max. 0.62 mm in length. At all other areas the mold protrusion is maximum 0.15 mm per side. See also detail B.
(2)	The metal protrusion (tie bars) in the corner will not stick out of the molding compound protrusions (detail A).
(3)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(4)	The lead coplanarity over all leads is 0.1 mm maximum.
(5)	Dimension is measured 0.5 mm from the edge of the top package body.
(6)	The hatched area indicates the exposed metal heatsink.
(7)	The leads and exposed heatsink are plated with matte Tin (Sn).



Package outline drawing: SOT1138-3	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 1 Revision date: 7/26/2018
		Third angle projection	Sheet 2 of 2

Fig 12. Package outline SOT1138-3 (sheet 2 of 2)

SOT1204-3

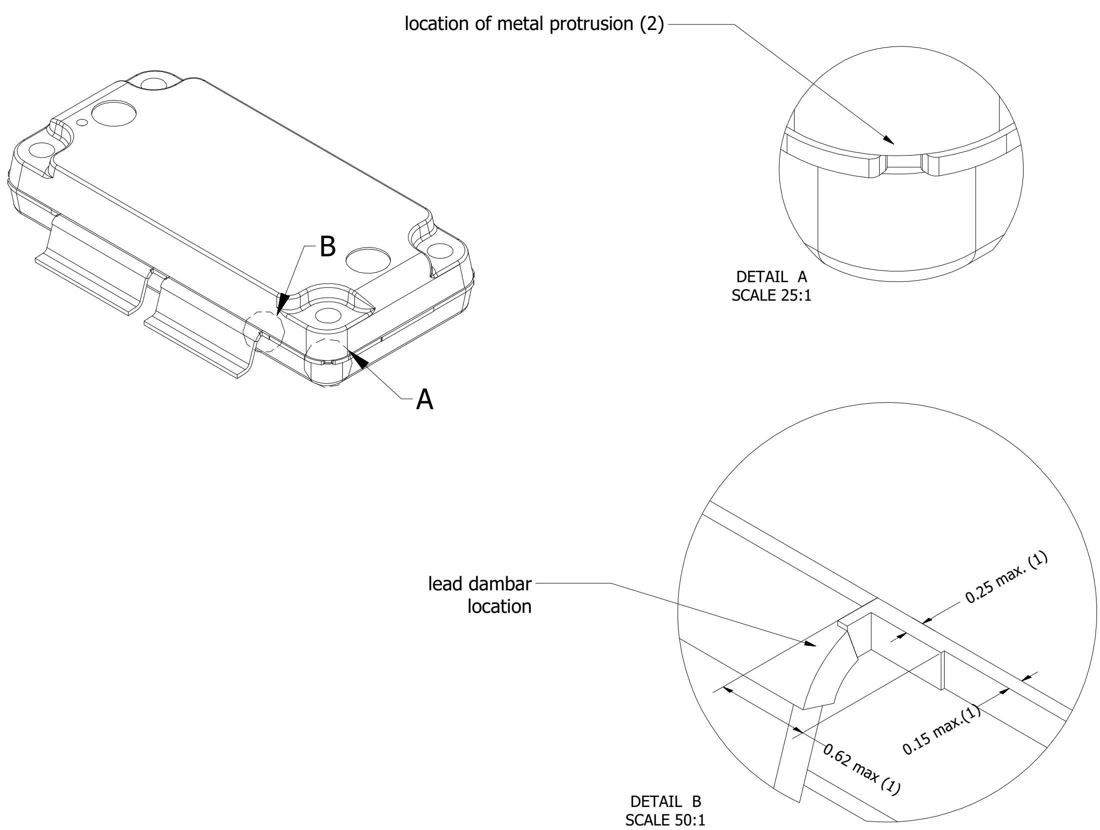


Package outline drawing:	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 1 Revision date: 7/26/2018
SOT1204-3		Third angle projection	Sheet 1 of 2

Fig 13. Package outline SOT1204-3 (sheet 1 of 2)

SOT1204-3

Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. All areas located adjacent to the leads have a maximum mold protrusion of 0.25 mm (per side) and 0.62 mm max. in length. At other areas the mold protrusion is maximum 0.15 mm per side. See also detail B.
(2)	The metal protrusion (tie bars) in the corner will not stick out of the molding compound protrusions (detail A).
(3)	The lead dambar (metal) protrusions are not included. Add 0.14 mm max to the total lead dimension at the dambar location.
(4)	The hatched area indicated the exposed heatsink.
(5)	The leads and exposed heatsink are plated with matte Tin (Sn).
(6)	Dimension is measured with respect to the bottom of the heatsink Datum H. Positive value means that the bottom of the heatsink is higher than the bottom of the lead.
(7)	Gage plane (foot length) to be measured from the seating plane.



Package outline drawing: SOT1204-3	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 1 Revision date: 7/26/2018
		Third angle projection	Sheet 2 of 2

Fig 14. Package outline SOT1204-3 (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 11. 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 12. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
MTF	Median Time to Failure
SMD	Surface Mounted Device
RoHS	Restriction of Hazardous Substances
VSWR	Voltage Standing Wave Ratio

11. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLP05H6700XR_H6700XRG v.2	20180913	Product data sheet	-	BLP05H6700XR_H6700XRG v.1
Modifications	• Table 2 on page 2: package outline versions changed to SOT1138-3 and SOT1204-3 • Table 3 on page 2: package outline versions changed to SOT1138-3 and SOT1204-3 • Figure 4 on page 6: figure updated • Section 8 on page 9: package outline versions changed from SOT1138-2 and SOT1204-2 to SOT1138-3 and SOT1204-3			
BLP05H6700XR_H6700XRG v.1	20170217	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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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

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