BLP05H675XR; BLP05H675XRG

Power LDMOS transistor

AMPLEON

Rev. 4 — 1 September 2016

Product data sheet

1. Product profile

1.1 General description

A 75 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	75	27	75

1.2 Features and benefits

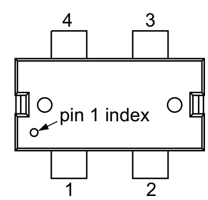
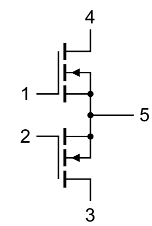
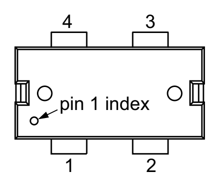
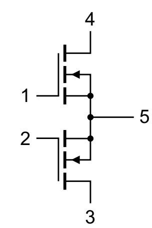
- Easy power control
- Integrated double sided ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (HF to 600 MHz)
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- Industrial, scientific and medical applications
- Broadcast transmitter applications

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
BLP05H675XR (SOT1223-2)			
1	gate 2		 aaa-003574
2	gate 1		
3	drain 1		
4	drain 2		
5	source [1]		
BLP05H675XRG (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
BLP05H675XR	HSOP4F	plastic, heatsink small outline package; 4 leads (flat)	SOT1223-2
BLP05H675XRG	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

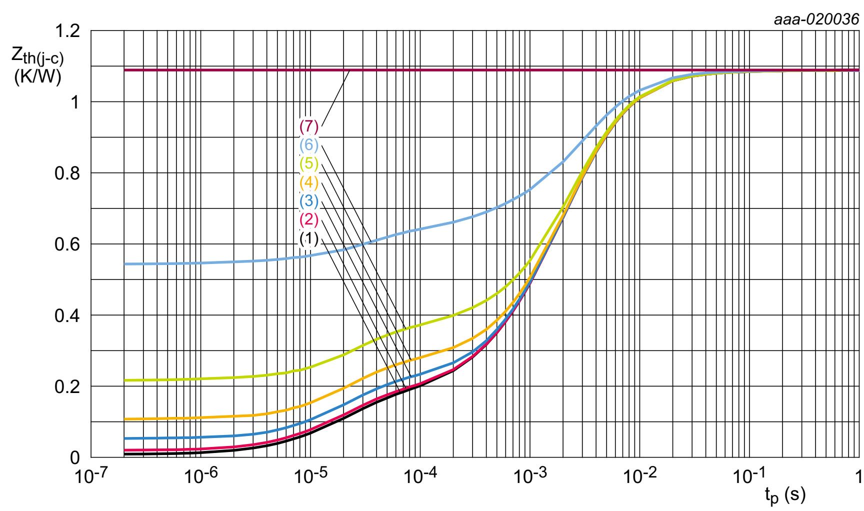
Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	T_j = 115 °C	[1][2]	1.09	K/W
$Z_{th(j-c)}$	transient thermal impedance from junction to case	T_j = 150 °C; t_p = 100 μs; δ = 20 %	[3]	0.37	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 = 0.25 mA	135	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 25 mA	1.25	1.8	2.25	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 50 V; I_D = 10 mA	-	1.7	-	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V	-	-	1.4	μA

Table 6. DC characteristics *...continued*
T_j = 25 °C; per section unless otherwise specified.

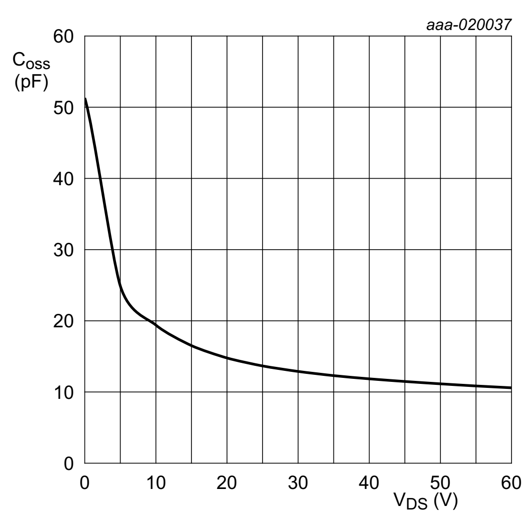
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75$ V; V_{DS} = 10 V	-	3.6	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75$ V; I_D = 875 mA	-	1.6	-	Ω

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	-	0.25	-	pF
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	31	-	pF
C_{oss}	output capacitance	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz	-	11	-	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} = 20 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 = 75 W	25.5	27	-	dB
RL_{in}	input return loss	P_L = 75 W	-	−15	-	dB
η_D	drain efficiency	P_L = 75 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 BLP05H675XR and BLP05H675XRG 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} = 20 mA; P_L = 75 W pulsed; f = 108 MHz.

7.2 Impedance information

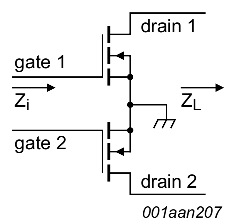


Fig 3. Definition of transistor impedance

Table 9. Typical push-pull impedance

Simulated Z_i and Z_L device impedance; impedance info at V_{DS} = 50 V and P_L = 75 W.

f	Z_i	Z_L
(MHz)	(Ω)	(Ω)
108	29.6 − j143.4	51.1 + j11.7

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)
2	0.13
2.5	0.1
3	0.08

For information see application note *AN10273*.

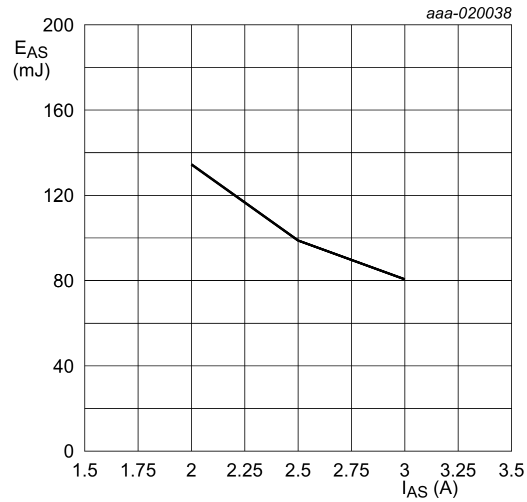
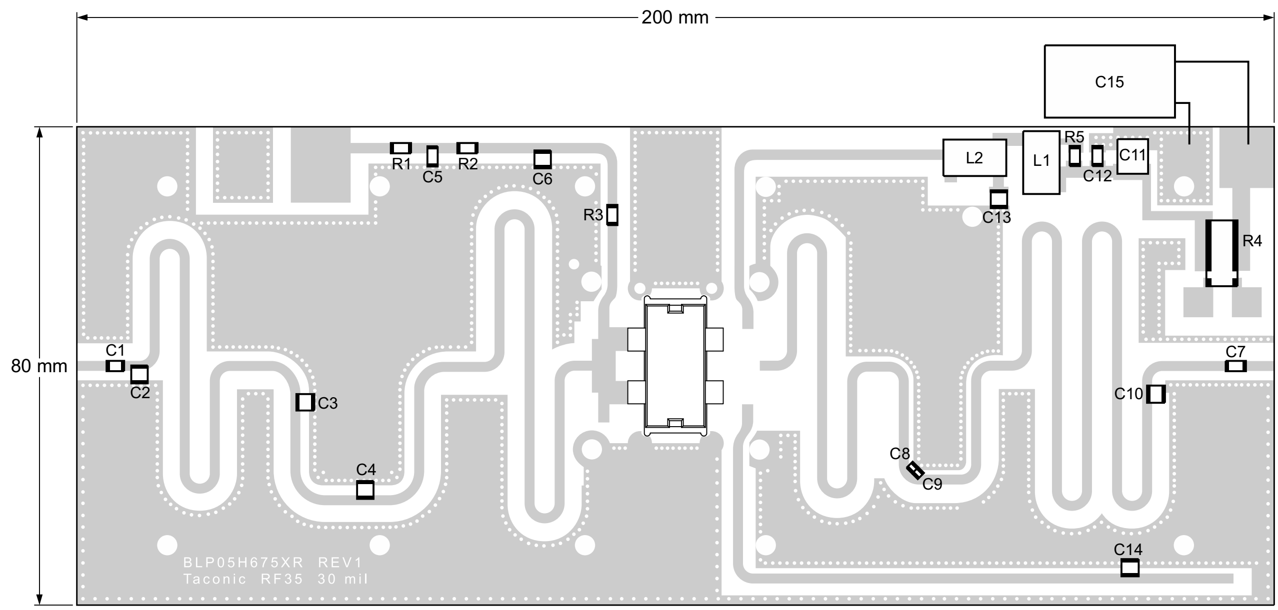


Fig 4. Non-repetitive avalanche energy as a function of single pulse avalanche current; typical values

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, C7	multilayer ceramic chip capacitor	470 pF	ATC 800B
C2	multilayer ceramic chip capacitor	82 pF	ATC 800B
C3	multilayer ceramic chip capacitor	270 pF	ATC 800B
C4	multilayer ceramic chip capacitor	22 pF	ATC 800B
C5	multilayer ceramic chip capacitor	1 µF, 50 V	GRM32RR71H105KA01L
C6, C13	multilayer ceramic chip capacitor	820 pF	ATC 800B
C8, C9	multilayer ceramic chip capacitor	36 pF	ATC 100A
C10	multilayer ceramic chip capacitor	18 pF	ATC 800B
C11	multilayer ceramic chip capacitor	4.7 µF, 100 V	C5750X7RA475KT/A
C12	multilayer ceramic chip capacitor	100 nF	GRM188R72A104KA35D
C14	multilayer ceramic chip capacitor	15 pF	ATC 800B
C15	electrolytic capacitor	2200 µF, 63 V	Vishay
L1	wire inductor	169 nH	Coilcraft:132-12SMG
L2	wire inductor	90 nH	Coilcraft:132-9SMG
R1, R2	resistor	10 Ω	SMD 1206

Table 11. List of components *...continued*

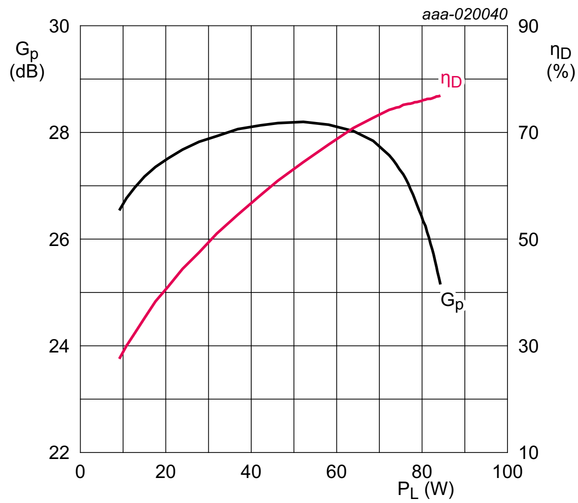
For test circuit see Figure 5.

Component	Description	Value	Remarks
R3	resistor	4.64 kΩ	SMD 0805
R4	shunt resistor	10 mΩ	Ohmite: FC4L110R010FER
R5	resistor	7.5 Ω, 0.6 W	SMD 1206

7.5 Graphical data

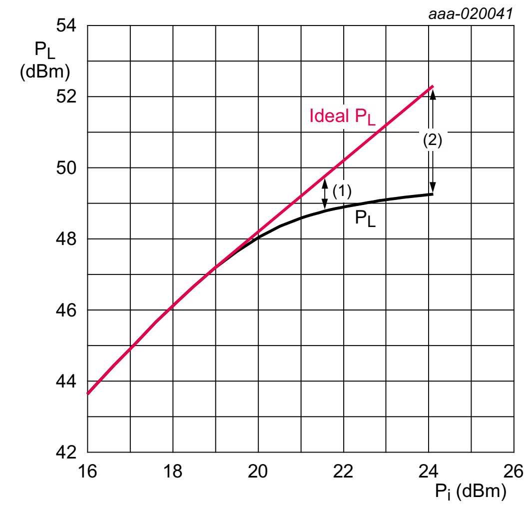
The following figures are measured in a class-AB production test circuit.

7.5.1 1-Tone CW pulsed



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

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

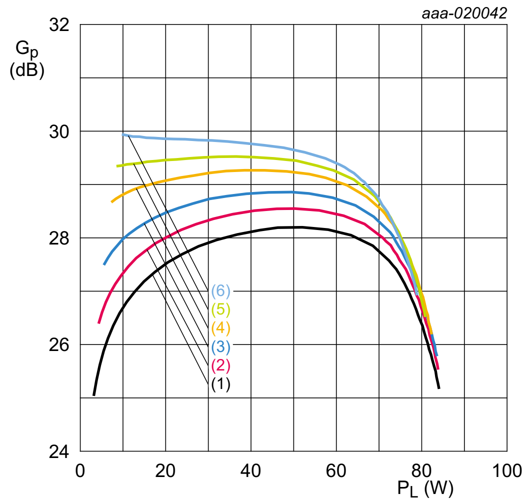


V_{DS} = 50 V; I_{Dq} = 20 mA; f = 108 MHz; t_p = 100 μs; δ = 20 %.

(1) $P_{L(1dB)}$ = 48.8 dBm (75.6 W) at P_i = 21.6 dBm

(2) $P_{L(3dB)}$ = 49.25 dBm (83.5 W) at P_i = 24.2 dBm

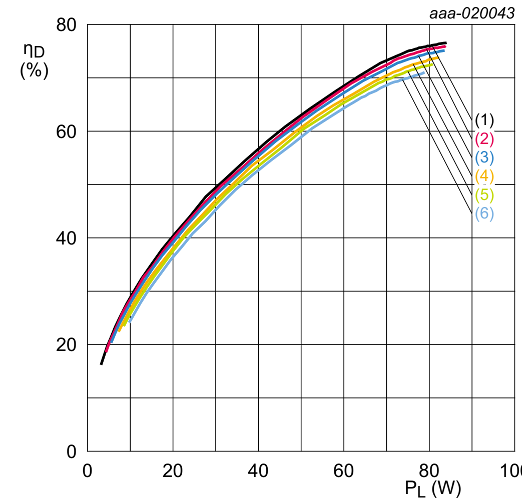
Fig 7. Output power as a function of input power; typical values



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

(1) I_{Dq} = 20 mA
(2) I_{Dq} = 50 mA
(3) I_{Dq} = 100 mA
(4) I_{Dq} = 200 mA
(5) I_{Dq} = 300 mA
(6) I_{Dq} = 400 mA

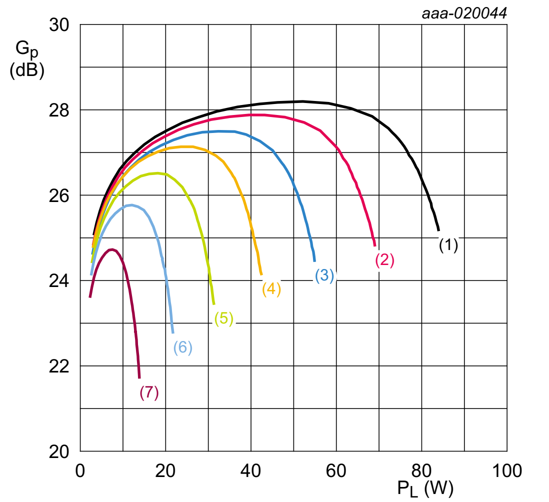
Fig 8. Power gain as a function of output power; typical values



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

(1) I_{Dq} = 20 mA
(2) I_{Dq} = 50 mA
(3) I_{Dq} = 100 mA
(4) I_{Dq} = 200 mA
(5) I_{Dq} = 300 mA
(6) I_{Dq} = 400 mA

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



I_{Dq} = 20 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

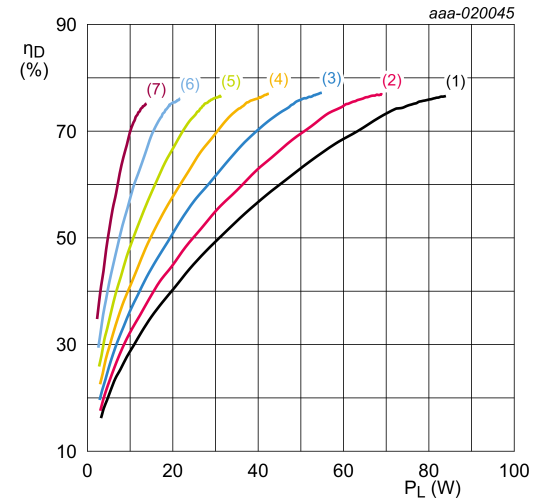
(4) V_{DS} = 35 V

(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} = 20 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

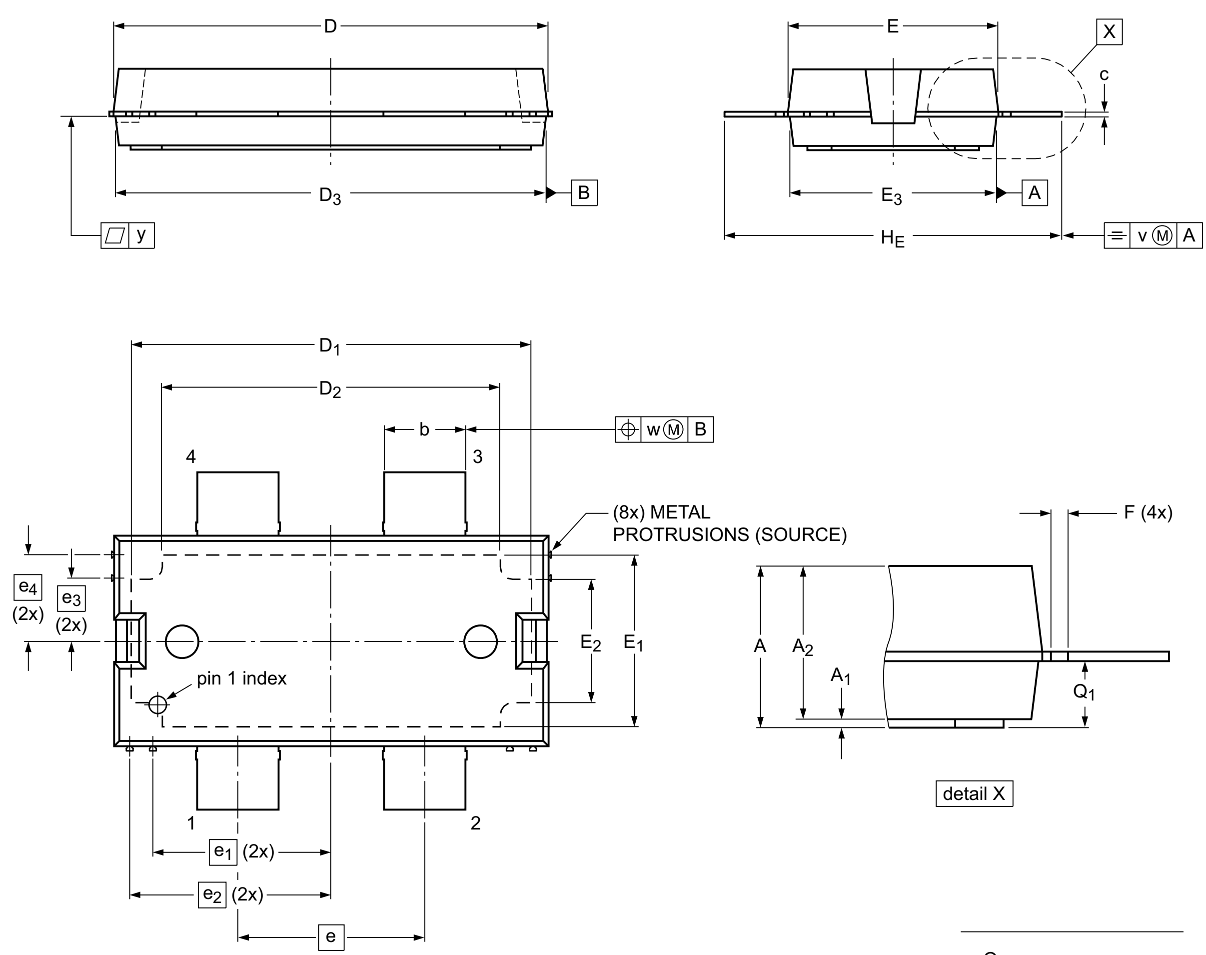
(6) V_{DS} = 25 V

(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

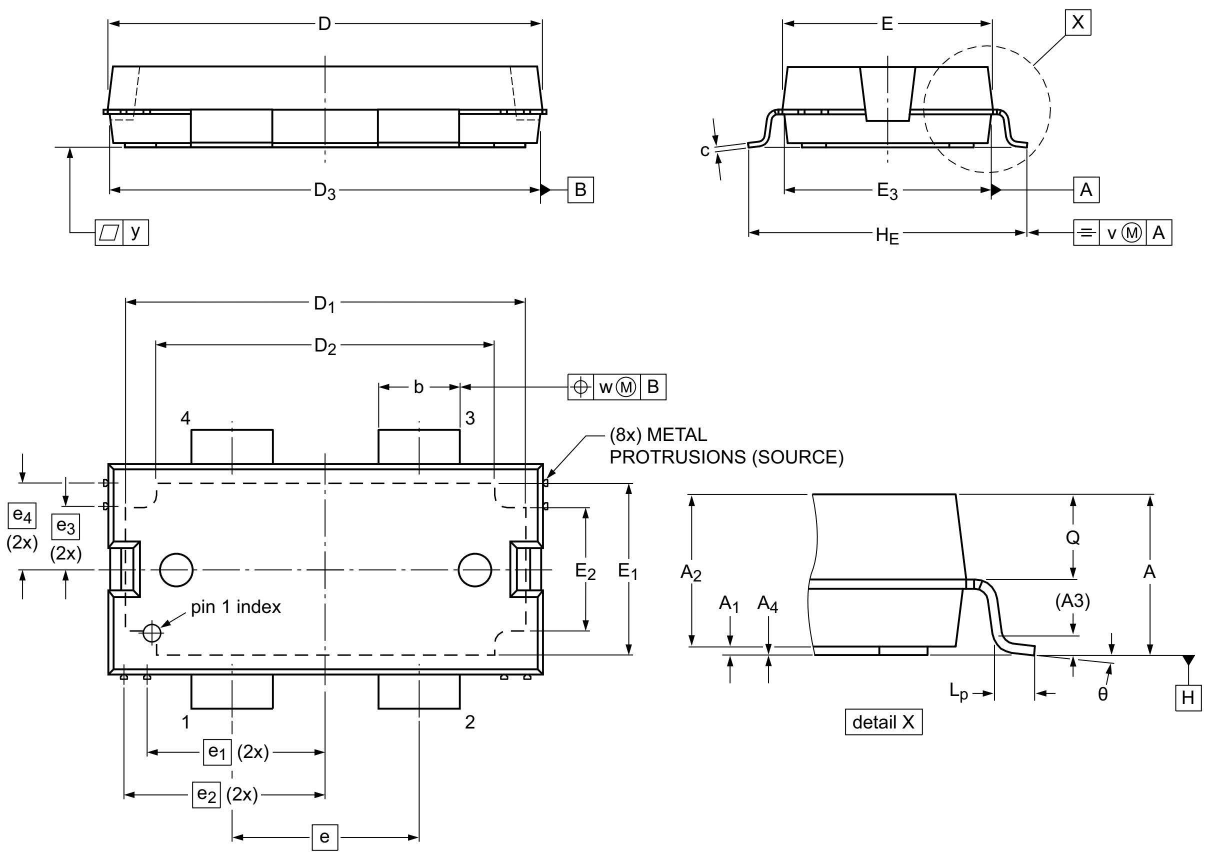
Note
1. Package body dimensions “D and “E do not include mold and metal protrusions. Allowable protrusion is 0.25 mm per side.
2. Lead width dimension “b does not include dambar protrusions. Allowable dambar protrusion is 0.25 mm in total per lead.

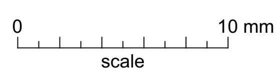
sot1223-2_po

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)

HSOP4: plastic, heatsink small outline package; 4 leads **SOT1224-2**





H_E	L_p	Q	v	w	y	θ
13.5	1.10	2.07			0.1	7°
13.2	0.95	2.02	0.25	0.25		3°
12.9	0.80	1.97				0°

Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	A_4	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
	max	3.9	0.2	3.65		0.06	3.90	0.27	20.62	19.00	16.05	20.44	10.01	8.18	5.89	9.83					
mm	nom		0.1	3.60	0.35	0	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
	min		0	3.55		-0.02	3.80	0.17	20.52	18.90	15.95	20.34	9.91	8.08	5.79	9.73					

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.
3. Dimension A_4 is measured with respect to bottom of the heatsink DATUM H. Positive value means that the bottom of the heatsink is higher than the bottom of the lead.

sot1224-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1224-2						~~15-01-13~~ 15-06-04

Fig 13. 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
BLP05H675XR_H675XRG v.4	20160901	Product data sheet	-	BLP05H675XR v.3
Modifications:	• The document now describes both the straight lead and gull-wing versions of this product: BLP05H675XR and BLP05H675XRG respectively • Table 2 on page 2: added BLP05H675XRG data • Table 3 on page 2: added BLP05H675XRG data • Section 7.1 on page 5: added BLP05H675XRG • Figure 13 on page 12: added figure SOT1224-2			
BLP05H675XR v.3	20160122	Product data sheet	-	BLP05H675XR#2
BLP05H675XR#2	20150901	Objective data sheet	-	BLP05H675XR v.1
BLP05H675XR 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.

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13. Contact information

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

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Date of release: 1 September 2016
Document identifier: BLP05H675XR_H675XRG