BLM2425M7S60P

LDMOS 2-stage power MMIC

Rev. 5 — 13 September 2018

AMPLEON

Product data sheet

1. Product profile

1.1 General description

60W dual path, 2-stage power MMIC transistor for Industrial, Scientific and Medical (ISM) applications at frequencies from 2400 MHz to 2500 MHz.

The BLM2425M7S60P is designed for high power CW applications and is assembled in a high performance plastic package.

Table 1. Application performance

Per section unless otherwise specified.

Test signal	f	V_{DS}	P_L	G_p	η_D
	(MHz)	(V)	(W)	(dB)	(%)
CW	2450	32	30	27.5	45

1.2 Features and benefits

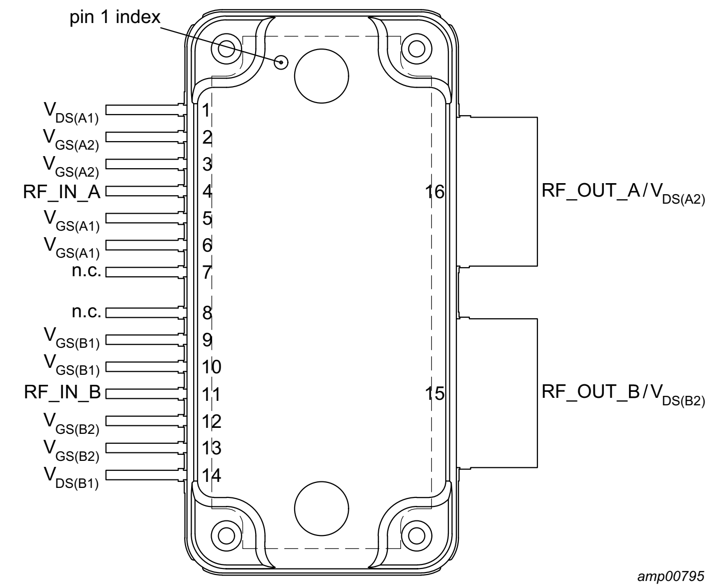
- High efficiency
- High power gain
- Excellent ruggedness
- Excellent thermal stability
- Integrated ESD protection
- Biasing of individual stages is externally accessible
- On-chip matching for ease of use
- Designed for broadband operation (frequency 2400 MHz to 2500 MHz)
- For RoHS compliance see the product details on the Ampleon website

1.3 Applications

Industrial, scientific and medical applications in the frequency range 2400 MHz to 2500 MHz.

2. Pinning information

2.1 Pinning



Transparent top view

The exposed backside of the package is the ground terminal of the device.

Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$V_{DS(A1)}$	1	drain-source voltage of stage A1
$V_{GS(A2)}$	2, 3	gate-source voltage of stage A2
RF_IN_A	4	RF input path A
$V_{GS(A1)}$	5, 6	gate-source voltage of stage A1
n.c.	7	not connected
n.c.	8	not connected
$V_{GS(B1)}$	9, 10	gate-source voltage of stage B1
RF_IN_B	11	RF input path of B
$V_{GS(B2)}$	12, 13	gate-source voltage of stage B2
$V_{DS(B1)}$	14	drain-source voltage of stage B1
RF_OUT_B/$V_{DS(B2)}$	15	RF output path B / drain source voltage of stage B2
RF_OUT_A/$V_{DS(A2)}$	16	RF output path A / drain source voltage of stage A2
GND	flange	RF ground

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLM2425M7S60P	-	plastic, heatsink small outline package; 16 leads (flat)	SOT1211-3

4. Block diagram

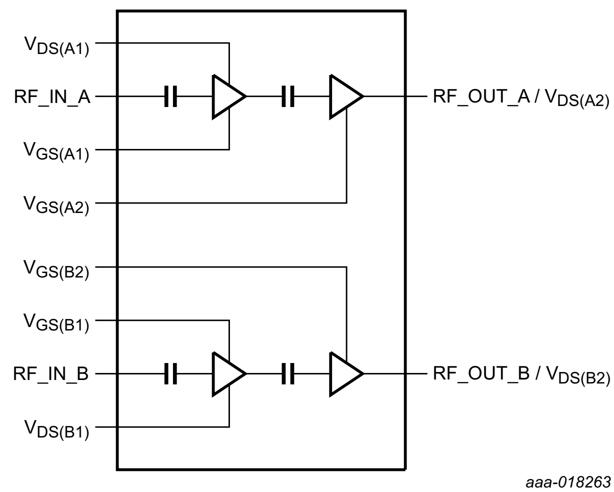


Fig 2. Block diagram of BLM2425M7S60P

5. 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		-	65	V
V_{GS}	gate-source voltage		−0.5	+13	V
$V_{GS(sense)}$	sense gate-source voltage		−0.5	+9	V
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature	[1]	-	225	°C
T_{case}	case temperature		-	150	°C

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

6. Thermal characteristics

Table 5. Thermal characteristics
Measured for total device.

Symbol	Parameter	Conditions	Value	Unit
$R_{th(j-c)}$	thermal resistance from junction to case	final stage; T_{case} = 90 °C; P_L = 60 W [1]	0.91	K/W

[1] When operated with a CW signal.

7. Characteristics

Table 6. DC characteristics
T_{case} = 25 °C; per section unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Final stage						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.422 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 42 mA	1.5	1.9	2.3	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 253 mA	1.7	2.1	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	7.8	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 1478 mA	-	2.85	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 1.48 A	-	350	-	mΩ
I_{Dq}	quiescent drain current	main transistor: V_{DS} = 28 V sense transistor: I_D = 7 mA; V_{DS} = 28 V	208	233	257	mA
Driver stage						
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.116 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 11.6 mA	1.4	1.9	2.4	V
V_{GSq}	gate-source quiescent voltage	V_{DS} = 28 V; I_D = 69.6 mA	1.7	2.1	2.5	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.4	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	2.2	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	140	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 406 mA	-	0.8	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 0.4 A	-	2350	-	mΩ
I_{Dq}	quiescent drain current	main transistor: V_{DS} = 28 V sense transistor: I_D = 7 mA; V_{DS} = 28 V	67	75	83	mA

Table 7. RF Characteristics

Test signal: CW at f = 2450 MHz; RF performance at V_{DS} = 32 V; I_{Dq1} = 25 mA; I_{Dq2} = 50 mA; T_{case} = 25 °C; per section unless otherwise specified; in a class-AB production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G_p	power gain	P_L = 30 W	26	27.5	-	dB
η_D	drain efficiency	P_L = 30 W	41.5	45	-	%
RL_{in}	input return loss	P_L = 30 W	-	−18	−13.8	dB

8. Test information

8.1 Ruggedness

The BLM2425M7S60P is capable of withstanding a load mismatch corresponding to VSWR = 15 : 1 through all phases under the following conditions: V_{DS} = 32 V; I_{Dq1} = 25 mA; I_{Dq2} = 50 mA; f = 2450 MHz; per section unless otherwise specified.

8.2 Impedance information

Table 8. Typical impedance

Measured load-pull data. Typical values per section unless otherwise specified.

f	Z_S [1]	Z_L [1]
(MHz)	(Ω)	(Ω)
2400	19.1 + j43.2	5.3 − j2.4
2450	16.8 + j38.8	5.0 − j2.3
2500	14.4 + j33.0	4.4 − j2.4

[1] Z_S and Z_L defined in Figure 3

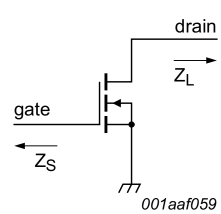
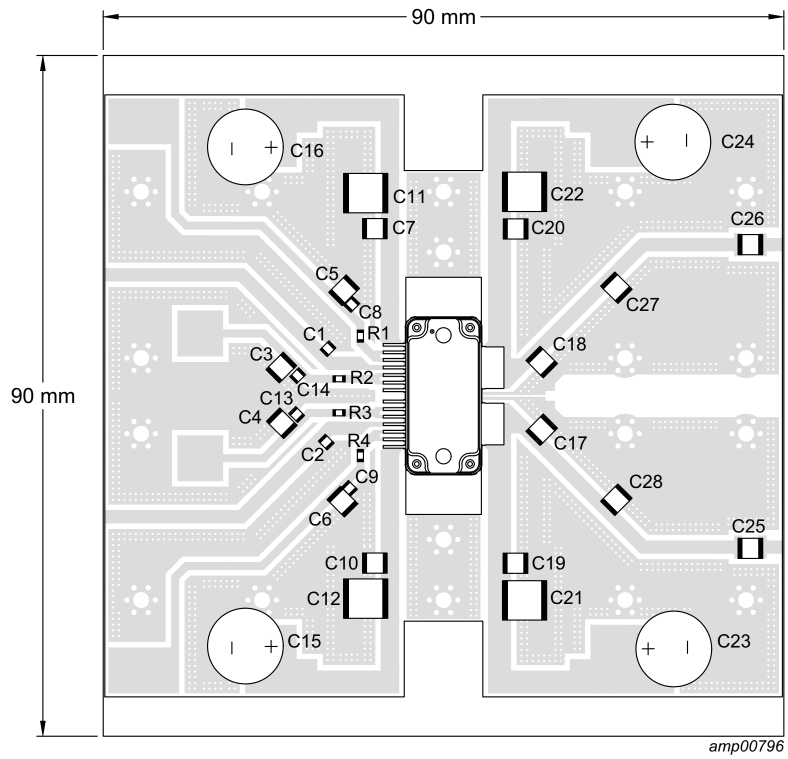


Fig 3. Definition of transistor impedance

8.3 Test circuit



Printed-Circuit Board (PCB): Rogers RO4350; ε_r = 3.48; height = 0.762 mm; thickness copper plating = 35 μm.

See Table 9 for a list of components.

Fig 4. Component layout

Table 9. List of components

See Figure 4 for component layout.

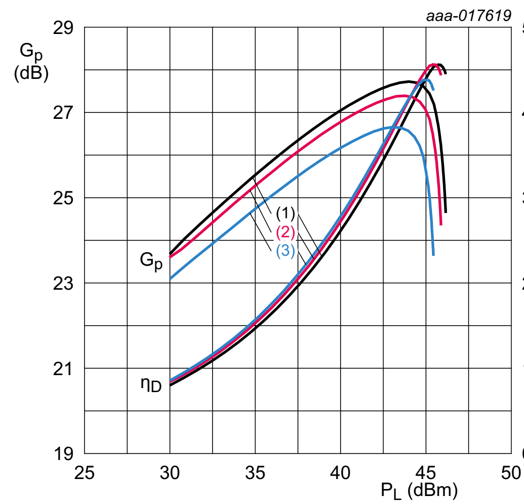
Component	Description	Value	Remarks
C1, C2	multilayer ceramic chip capacitor	1 pF [1]	
C3, C4, C5, C6	multilayer ceramic chip capacitor	1 μF, 50 V	Murata: GRM32RR71H105KA01L
C7, C10	multilayer ceramic chip capacitor	8.2 pF [2]	
C8, C9, C13, C14	multilayer ceramic chip capacitor	8.2 pF [1]	
C11, C12, C21, C22	multilayer ceramic chip capacitor	10 μF, 50 V	
C15, C16, C23, C24	electrolytic capacitor	220 μF, 63 V [2]	
C17, C18	multilayer ceramic chip capacitor	1.6 pF [2]	
C19, C20, C25, C26	multilayer ceramic chip capacitor	8.2 pF [2]	
C27, C28	multilayer ceramic chip capacitor	0.4 pF [2]	
R1, R2, R3, R4	SMD resistor	0 Ω	SMD 0805

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

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

8.4 Graphical data

Performance curves are measured per section.



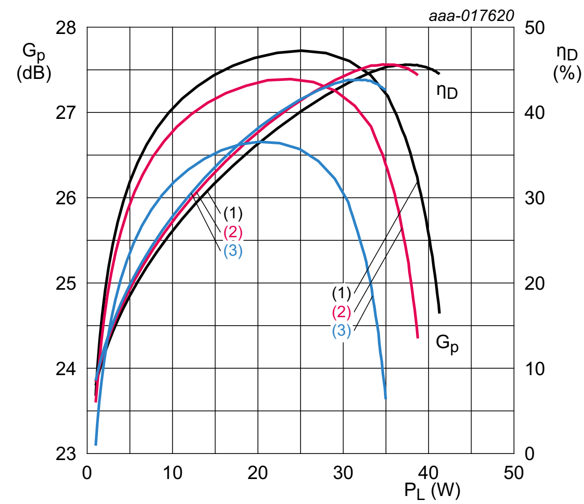
V_{DS} = 32 V; I_{Dq1} = 25 mA; I_{Dq2} = 50 mA.

(1) f = 2400 MHz

(2) f = 2450 MHz

(3) f = 2500 MHz

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



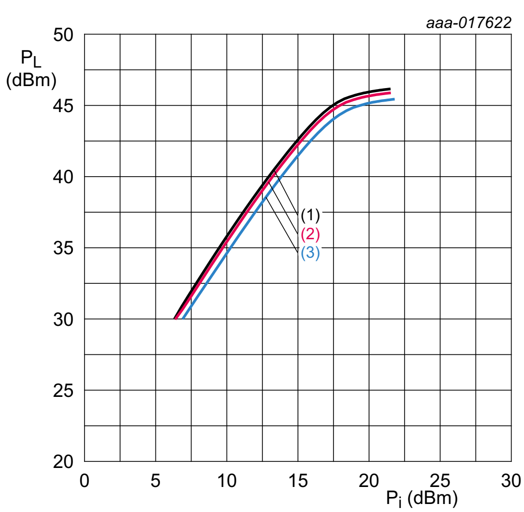
V_{DS} = 32 V; I_{Dq1} = 25 mA; I_{Dq2} = 50 mA.

(1) f = 2400 MHz

(2) f = 2450 MHz

(3) f = 2500 MHz

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



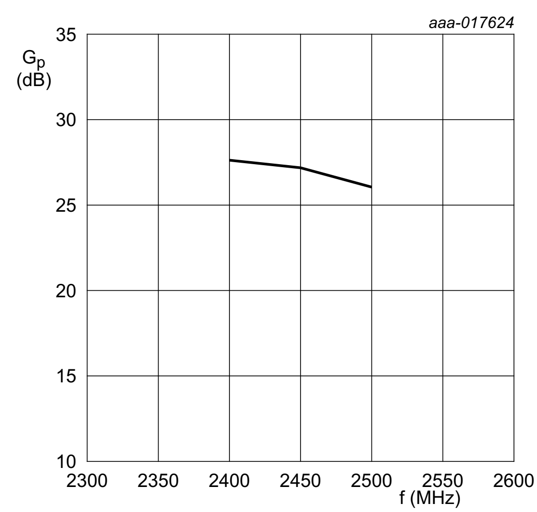
V_{DS} = 32 V; I_{Dq1} = 25 mA; I_{Dq2} = 50 mA.

(1) f = 2400 MHz

(2) f = 2450 MHz

(3) f = 2500 MHz

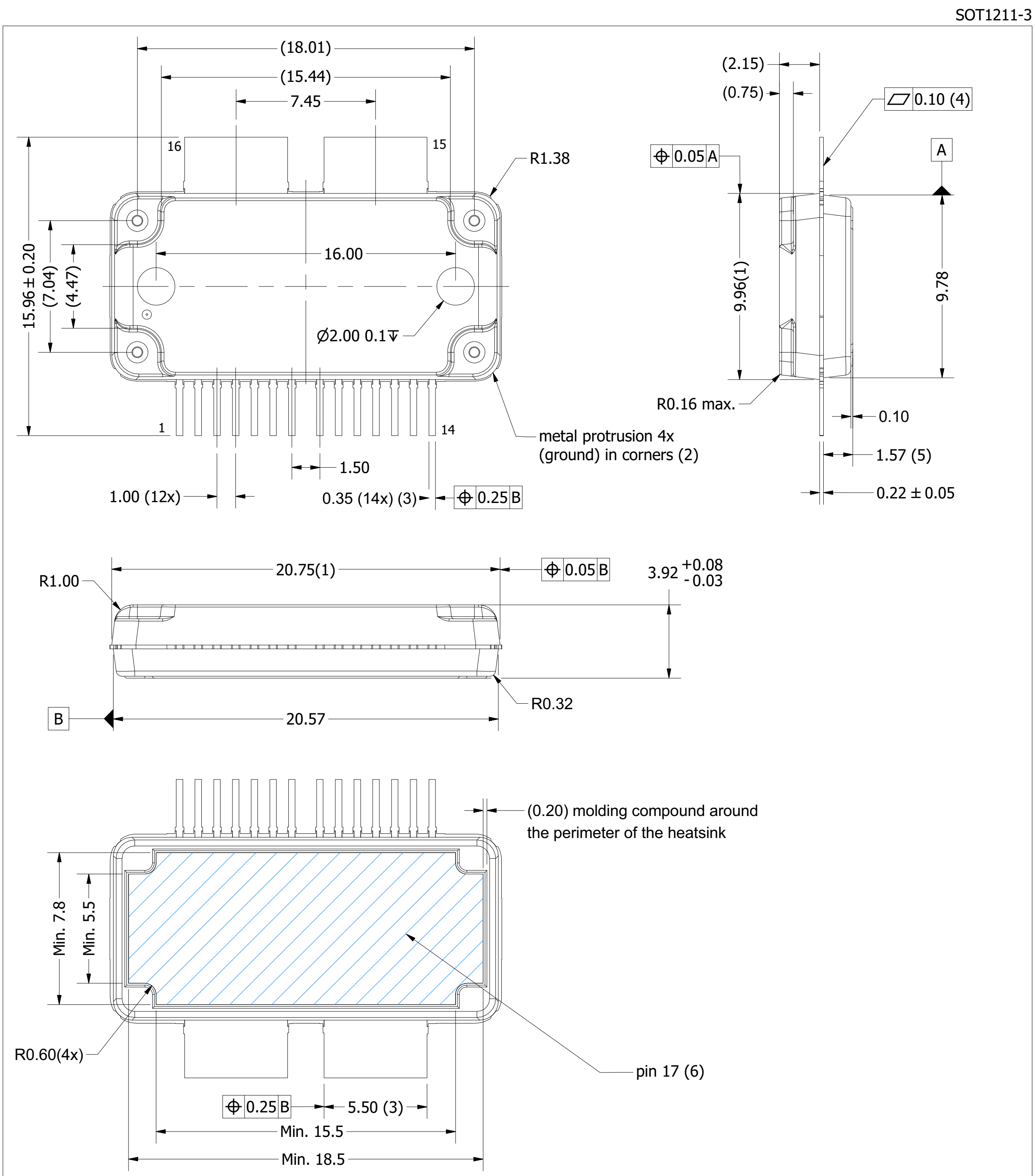
Fig 7. Output power as a function of input power; typical values



V_{DS} = 32 V; I_{Dq1} = 25 mA; I_{Dq2} = 50 mA; P_L = 30 W.

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

9. Package outline

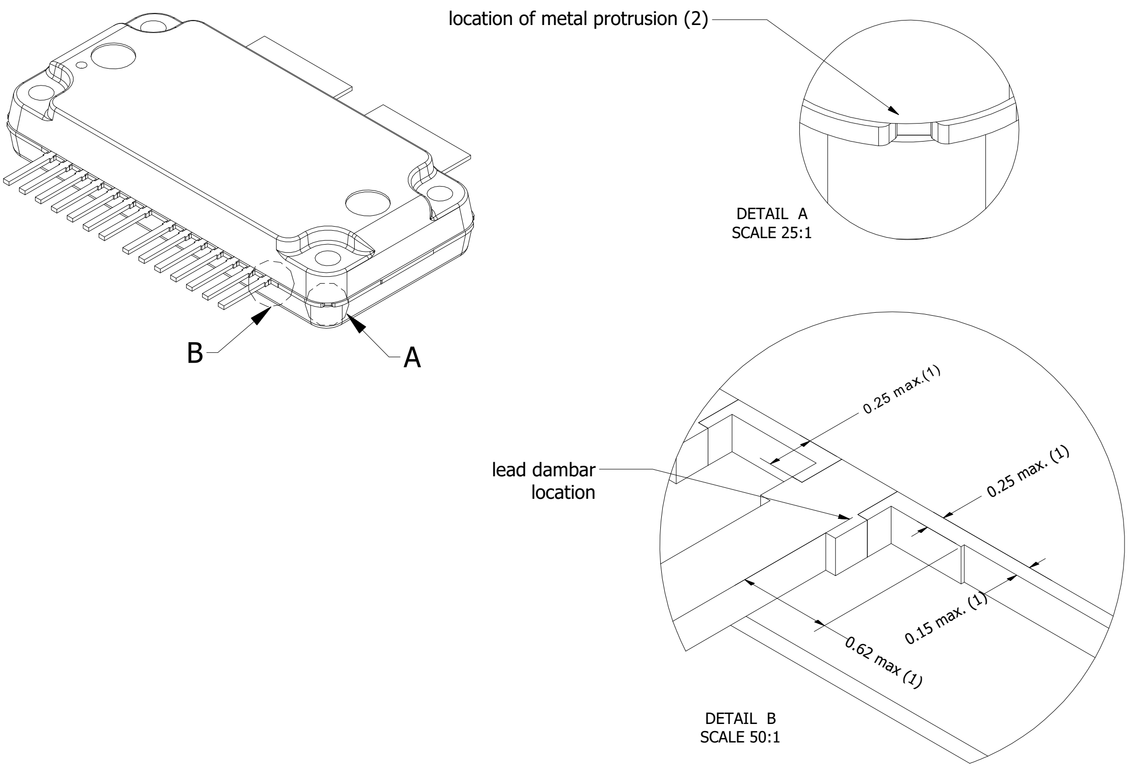


Package outline drawing: SOT1211-3	units in mm.	Tolerances unless otherwise stated: Dimension: ± 0.05 Angle: ± 1°	Revision: 1 Revision date: 7/26/2018
		Third angle projection	Sheet 1 of 2

Fig 9. Package outline SOT1211-3 (sheet 1 of 2)

SOT1211-3

Drawing Notes	
Items	Description
(1)	Dimensions are excluding mold protrusion. Areas located adjacent to the leads have a maximum mold protrusion of 0.25 mm (per side) and 0.62 mm max. in length. In between the 14 leads the protrusion is 0.25 mm. max. 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: SOT1211-3	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 10. Package outline SOT1211-3 (sheet 2 of 2)

10. 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 10. 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	1A [2]

[1] CDM classification C2A is granted to any part that passes after exposure to an ESD pulse of 500 V.

[2] HBM classification 1A is granted to any part that passes after exposure to an ESD pulse of 250 V.

11. Abbreviations

Table 11. Abbreviations

Acronym	Description
CW	Continuous Wave
ESD	ElectroStatic Discharge
LDMOS	Laterally Diffused Metal Oxide Semiconductor
MMIC	Monolithic Microwave Integrated Circuit
MTF	Median Time to Failure
RoHS	Restriction of Hazardous Substances
SMD	Surface Mounted Device
VSWR	Voltage Standing Wave Ratio

12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLM2425M7S60P v.5	20180913	Product data sheet	-	BLM2425M7S60P v.4
Modifications:	• Figure 1 on page 2; figure updated • Table 3 on page 3; package outline version changed from SOT1211-2 to SOT1211-3 • Figure 4 on page 6; figure updated • Section 9 on page 8; package outline version changed from SOT1211-2 to SOT1211-3			
BLM2425M7S60P v.4	20170629	Product data sheet	-	BLM2425M7S60P v.3
BLM2425M7S60P v.3	20150909	Product data sheet	-	BLM2425M7S60P#2
BLM2425M7S60P#2	20150901	Objective	-	BLM2425M7S60P v.1
BLM2425M7S60P v.1	20150518	Objective data sheet	-	-

13. Legal information

13.1 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.

13.2 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.

13.3 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's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Ampleon's 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's standard warranty and Ampleon's 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.

13.4 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.

14. Contact information

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

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

15. Contents

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section ‘Legal information’.

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

Date of release: 13 September 2018
Document identifier: BLM2425M7S60P