BLU6H0410L-600P; BLU6H0410LS-600P Power LDMOS transistor

AMPLEON

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Product data sheet

Product profile

1.1 General description

A 600 W LDMOS RF power transistor for radar transmitter applications and industrial applications in the frequency range of 400 MHz to 900 MHz.

Table 1. **Application information**

Typical RF performance at $V_{DS} = 50 \text{ V}$; in a common source 860 MHz narrowband test circuit; unless otherwise specified.

Test signal	f	I _{Dq}	P _{L(AV)}	P _{L(M)}	Gp	η _D	IMD3
	(MHz)	(mA)	(W)	(W)	(dB)	(%)	(dBc)
pulsed, class-AB [1]	860	1.3	-	600	20	58	-

^[1] Measured at δ = 10 %; t_p = 1 ms.

1.2 Features and benefits

- Excellent ruggedness (VSWR ≥ 40 : 1 through all phases)
- Optimum thermal behavior and reliability, R_{th(i-c)} = 0.15 K/W
- High power gain
- High efficiency
- Internal input matching for high gain and optimum broadband operation
- Excellent reliability
- Easy power control
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

Power amplifier for radar transmitter applications in the 400 MHz to 900 MHz frequency range

2. Pinning information

Table 2. Pinning

Table 2.	i iiiiiiig			
Pin	Description		Simplified outline	Graphic symbol
BLU6H04	10L-600P (SOT539A)			
1	drain1			,
2	drain2		1 2	1
3	gate1		5	3
4	gate2		3 4	5
5	source	<u>[1]</u>		47
				' 2
				sym117

BLU6H04	110LS-600P (SOT539B)			
1	drain1		_	
2	drain2		1 2	.L
3	gate1		5	_
4	gate2		3 4	3 — F
5	source	[1]		4 7

^[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLU6H0410L-600P	-	flanged balanced LDMOST ceramic package; 2 mounting holes; 4 leads	SOT539A
BLU6H0410LS-600P	-	earless flanged balanced LDMOST ceramic package; 4 leads	SOT539B

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		-	110	V
V_{GS}	gate-source voltage		-0.5	+11	V
T _{stg}	storage temperature		-65	+150	°C
Tj	junction temperature		-	200	°C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Тур	Unit
R _{th(j-c)}	thermal resistance from junction to case	T _j = 150 °C	[1]	0.15	K/W
11(0)		T _j = 150 °C			
jun	junction to case	t_p = 100 μ s; δ = 10 %		0.020	K/W
		t_p = 200 μ s; δ = 10 %		0.023	K/W
		t_p = 300 μ s; δ = 10 %		0.025	K/W
		t_p = 500 μ s; δ = 10 %		0.028	K/W
		t_p = 100 μ s; δ = 20 %		0.035	K/W

^[1] $R_{th(j-c)}$ is measured under RF conditions.

6. Characteristics

Table 6. DC characteristics

 $T_i = 25$ °C; per section unless otherwise specified.

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0 \text{ V}; I_D = 2.4 \text{ mA}$	[1]	110	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_{D} = 240 mA	[1]	1.4	1.9	2.4	V
I _{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 50 V		-	-	2.8	μА
I _{DSX}	drain cut-off current	$V_{GS} = V_{GS(th)} + 3.75 V;$ $V_{DS} = 10 V$		-	36	-	Α
I _{GSS}	gate leakage current	$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}$		-	-	280	nΑ
R _{DS(on)}	drain-source on-state resistance	$V_{GS} = V_{GS(th)} + 3.75 \text{ V};$ $I_D = 8.5 \text{ A}$	[1]	-	143	-	mΩ
C _{iss}	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 50 \text{ V};$ f = 1 MHz	[2]	-	220	-	pF
C _{oss}	output capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 50 \text{ V};$ f = 1 MHz		-	74	-	pF
C _{rss}	reverse transfer capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 50 \text{ V};$ f = 1 MHz		-	1.2	-	pF

^[1] I_D is the drain current.

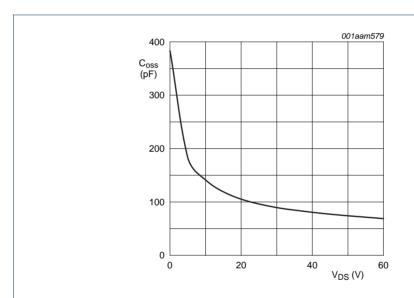
^[2] Capacitance values without internal matching.

Table 7. RF characteristics

Test signal: 2-Tone; $T_{case} = 25$ °C unless otherwise specified; in a class-AB Ampleon production narrowband test circuit.

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
V_{DS}	drain-source voltage			-	50	-	V
I _{Dq}	quiescent drain current]	1]	-	1.3	-	Α
$P_{L(AV)}$	average output power	f ₁ = 860 MHz; f ₂ = 860.1 MHz		250	-	-	W
G_p	power gain	f ₁ = 860 MHz; f ₂ = 860.1 MHz		20	21	-	dB
η_{D}	drain efficiency	f ₁ = 860 MHz; f ₂ = 860.1 MHz		42	46	-	%
IMD3	third-order intermodulation distortion	f ₁ = 860 MHz; f ₂ = 860.1 MHz		-	-32	-28	dBc

[1] I_{Dq} for total device.



 $V_{GS} = 0 V$; f = 1 MHz.

Fig 1. Output capacitance as a function of drain-source voltage; typical values per section

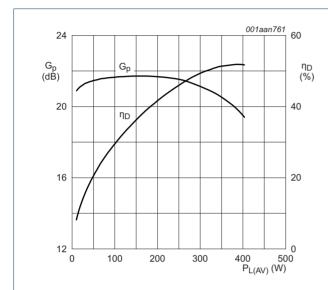
6.1 Ruggedness in class-AB operation

The BLU6H0410L-600P and BLU6H0410LS-600P are capable of withstanding a load mismatch corresponding to VSWR \geq 40 : 1 through all phases under the following conditions: V_{DS} = 50 V; f = 860 MHz at rated power.

7. Application information

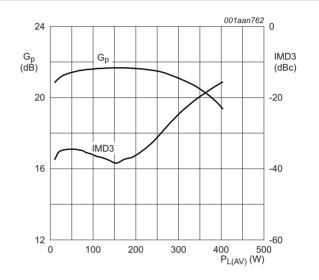
7.1 Narrowband RF figures

7.1.1 2-Tone



 V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source narrowband 860 MHz test circuit.

Fig 2. 2-Tone power gain and drain efficiency as function of load power; typical values



 V_{DS} = 50 V; I_{Dq} = 1.3 A; measured in a common source narrowband 860 MHz test circuit.

Fig 3. 2-Tone power gain and third order intermodulation distortion as function of load power; typical values

7.2 Impedance information

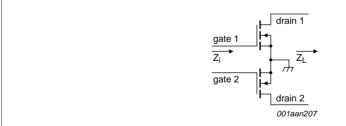


Fig 4. Definition of transistor impedance

Table 8. Typical push-pull impedance Simulated Z_i and Z_L device impedance; impedance info at $V_{DS} = 50 \text{ V}$ and $P_{L(M)} = 600 \text{ W}$.

f	Z i	Z _L
MHz	Ω	Ω
300	0.617 – j1.715	4.989 + j1.365
325	0.635 – j1.355	4.867 + j1.424
350	0.655 – j1.026	4.741 + j1.472
375	0.677 – j0.721	4.614 + j1.511

BLU6H0410L-600P_6H0410LS-600P#3

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Table 8. Typical push-pull impedance ...continued

Simulated Z_i and Z_L device impedance; impedance info at $V_{DS} = 50 \text{ V}$ and $P_{L(M)} = 600 \text{ W}$.

MHz Ω 400 0.702 – j0.435 4.486 + j1.540 425 0.731 – j0.164 4.357 + j1.559 450 0.762 + j0.096 4.228 + j1.570 475 0.798 + j0.347 4.100 + j1.573 500 0.839 + j0.592 4.974 + j1.567 525 0.884 + j0.833 3.850 + j1.554 550 0.936 + j1.072 3.728 + j1.534 575 0.995 + j1.310 3.608 + j1.508 600 1.063 + j1.549 3.492 + j1.475 625 1.141 + j1.791 3.378 + j1.437 650 1.230 + j2.037 3.268 + j1.394 675 1.334 + j2.289 3.161 + j1.347 700 1.456 + j2.548 3.057 + j1.295 725 1.599 + j2.814 2.957 + j1.239 750 1.768 + j3.090 2.860 + j1.180 775 1.971 + j3.376 2.676 + j1.118 800 2.214 + j3.671 2.677 + j1.053 825 2.510 + j3.975 2.591 + j0.985 850 2.873 + j4.282 2.508 + j0.915	f	Z _i	Z _L
425 0.731 - j0.164 4.357 + j1.559 450 0.762 + j0.096 4.228 + j1.570 475 0.798 + j0.347 4.100 + j1.573 500 0.839 + j0.592 4.974 + j1.567 525 0.884 + j0.833 3.850 + j1.554 550 0.936 + j1.072 3.728 + j1.534 575 0.995 + j1.310 3.608 + j1.508 600 1.063 + j1.549 3.492 + j1.475 625 1.141 + j1.791 3.378 + j1.437 650 1.230 + j2.037 3.268 + j1.394 675 1.334 + j2.289 3.161 + j1.347 700 1.456 + j2.548 3.057 + j1.295 725 1.599 + j2.814 2.957 + j1.239 750 1.768 + j3.090 2.860 + j1.180 775 1.971 + j3.376 2.676 + j1.118 800 2.214 + j3.671 2.677 + j1.053 825 2.510 + j3.975 2.591 + j0.985 850 2.873 + j4.282 2.508 + j0.915 875 3.320 + j4.584 2.428 + j0.843 900 3.875 + j4.865 2.351 + j0.770 925 4.562 + j5.095 2.277	MHz	Ω	Ω
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700	650	1.230 + j2.037	3.268 + j1.394
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825 2.510 + j3.975 2.591 + j0.985 850 2.873 + j4.282 2.508 + j0.915 875 3.320 + j4.584 2.428 + j0.843 900 3.875 + j4.865 2.351 + j0.770 925 4.562 + j5.095 2.277 + j0.695 950 5.409 + j5.223 2.206 + j0.618 975 6.426 + j5.166 2.138 + j0.540	775	1.971 + j3.376	2.676 + j1.118
850 2.873 + j4.282 2.508 + j0.915 875 3.320 + j4.584 2.428 + j0.843 900 3.875 + j4.865 2.351 + j0.770 925 4.562 + j5.095 2.277 + j0.695 950 5.409 + j5.223 2.206 + j0.618 975 6.426 + j5.166 2.138 + j0.540	800	2.214 + j3.671	2.677 + j1.053
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925 4.562 + j5.095 2.277 + j0.695 950 5.409 + j5.223 2.206 + j0.618 975 6.426 + j5.166 2.138 + j0.540	875	3.320 + j4.584	2.428 + j0.843
950 5.409 + j5.223 2.206 + j0.618 975 6.426 + j5.166 2.138 + j0.540	900	3.875 + j4.865	2.351 + j0.770
975 6.426 + j5.166 2.138 + j0.540	925	4.562 + j5.095	2.277 + j0.695
· · · · · · · · · · · · · · · · · · ·	950	5.409 + j5.223	2.206 + j0.618
1000 7.587 + j4.807 2.073 + j0.461	975	6.426 + j5.166	2.138 + j0.540
	1000	7.587 + j4.807	2.073 + j0.461

8. Test information

Table 9. List of components

For test circuit, see Figure 5, Figure 6 and Figure 7.

Component	Description	Value		Remarks
B1, B2	semi rigid coax	25 Ω ; 49.5 mm		UT-090C-25 (EZ 90-25)
C1	multilayer ceramic chip capacitor	12 pF	[1]	
C2, C3, C4, C5, C6	multilayer ceramic chip capacitor	8.2 pF	[1]	
C7	multilayer ceramic chip capacitor	6.8 pF	[2]	
C8	multilayer ceramic chip capacitor	2.7 pF	[2]	
C9	multilayer ceramic chip capacitor	2.2 pF	[2]	
C10, C13, C14	multilayer ceramic chip capacitor	100 pF	<u>[3]</u>	
C11, C12	multilayer ceramic chip capacitor	10 pF	[2]	
C15, C16	multilayer ceramic chip capacitor	4.7 μF; 50 V		Kemet C1210X475K5RAC-TU or capacitor of same quality.
C17, C18, C23, C24	multilayer ceramic chip capacitor	100 pF	[2]	
C19, C20	multilayer ceramic chip capacitor	10 μF; 50 V		TDK C570X7R1H106KT000N or capacitor of same quality.
C21, C22	electrolytic capacitor	470 μF; 63 V		
C30	multilayer ceramic chip capacitor	10 pF	<u>[4]</u>	
C31	multilayer ceramic chip capacitor	9.1 pF	<u>[4]</u>	
C32	multilayer ceramic chip capacitor	3.9 pF	<u>[4]</u>	
C33, C34, C35	multilayer ceramic chip capacitor	100 pF	<u>[4]</u>	
C36, C37	multilayer ceramic chip capacitor	4.7 μF; 50 V		TDK C4532X7R1E475MT020U or capacitor of same quality.
L1	microstrip	-	<u>[5]</u>	(W × L) 15 mm × 13 mm
L2	microstrip	-	<u>[5]</u>	(W \times L) 5 mm \times 26 mm
L3, L32	microstrip	-	<u>[5]</u>	(W \times L) 2 mm \times 49.5 mm
L4	microstrip	-	<u>[5]</u>	(W \times L) 1.7 mm \times 3.5 mm
L5	microstrip	-	<u>[5]</u>	(W \times L) 2 mm \times 9.5 mm
L30	microstrip	-	<u>[5]</u>	(W \times L) 5 mm \times 13 mm
L31	microstrip	-	<u>[5]</u>	(W \times L) 2 mm \times 11 mm
L33	microstrip	-	<u>[5]</u>	(W \times L) 2 mm \times 3 mm
R1, R2	wire resistor	10 Ω		
R3, R4	SMD resistor	5.6 Ω		0805
R5, R6	wire resistor	100 Ω		
R7, R8	potentiometer	10 kΩ		

^[1] American technical ceramics type 800R or capacitor of same quality.

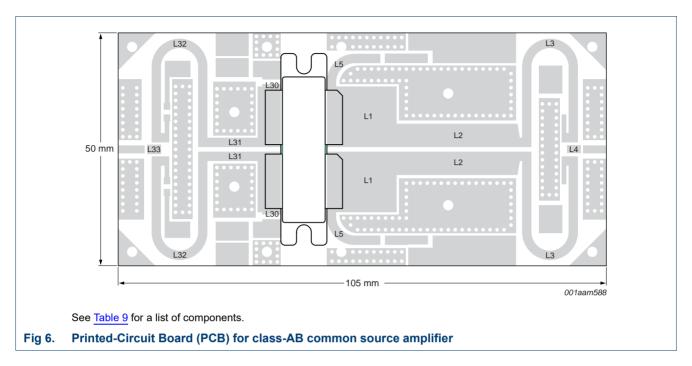
^[2] American technical ceramics type 800B or capacitor of same quality.

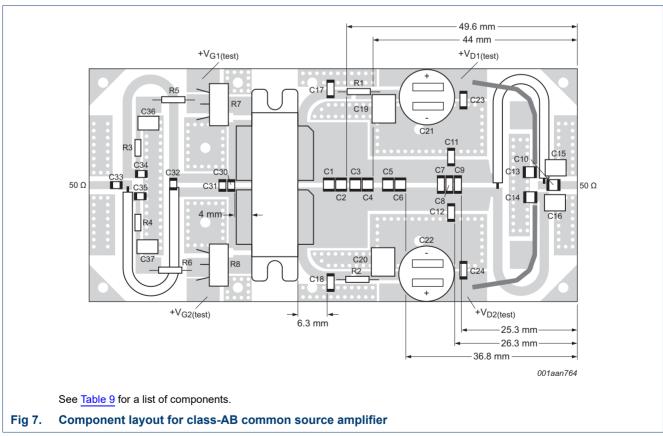
^[3] American technical ceramics type 180R or capacitor of same quality.

^[4] American technical ceramics type 100A or capacitor of same quality.

^[5] Printed-Circuit Board (PCB): Taconic RF35; ε_r = 3.5 F/m; height = 0.762 mm; Cu (top/bottom metallization); thickness copper plating = 35 μ m.

Product data sheet BLU6H0410L-600P_6H0410LS-600P#3 +V_{G1(test)} **□** C19 C17 = -+V_{D1(test)} All information provided in this document is subject to legal disclaimers ± C21 **‡**C23 Rev. 3 — 1 September 2015 **‡** C11 L32 L3 L31 | C32 50 Ω 50 Ω C8 C33 C10 L33 L4 C31 C30 B2 В1 C6 C7 C9 C2 **≠** C35 C14 = **=** C16 C37 **C**12 C18 = **C**20 +V_{G2(test)} 001aan763 © Ampleon The Netherlands B.V. 2015. All rights reserved. See Table 9 for a list of components. 8 of 15 Class-AB common source broadband amplifier; $V_{D1(test)}$, $V_{D2(test)}$, $V_{G1(test)}$ and $V_{G2(test)}$ are drain and gate test voltages Fig 5.





9. Package outline

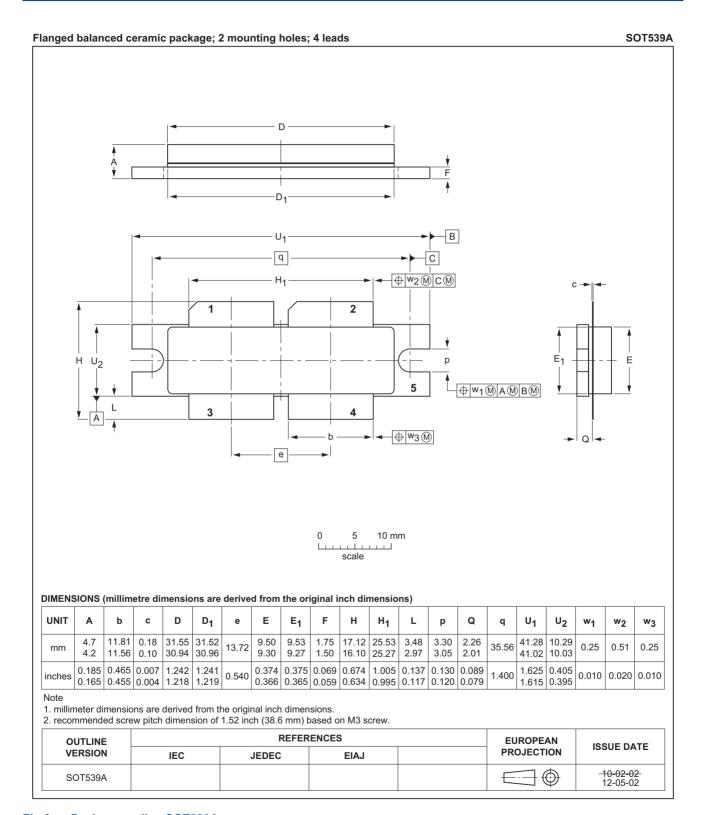


Fig 8. Package outline SOT539A

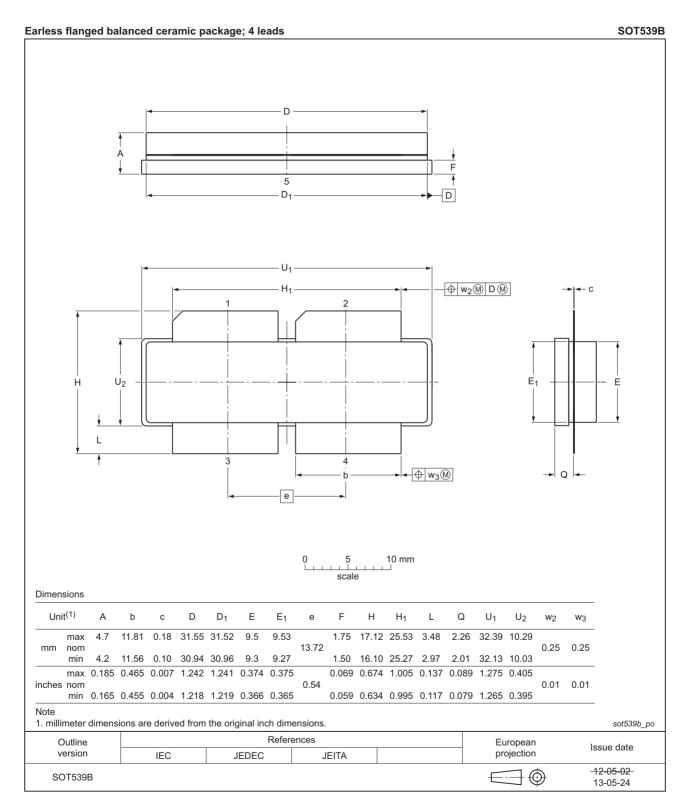


Fig 9. Package outline SOT539B

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.

11. Abbreviations

Table 10. Abbreviations

Acronym	Description
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
LDMOST	Laterally Diffused Metal-Oxide Semiconductor Transistor
RF	Radio Frequency
SMD	Surface Mounted Device
VSWR	Voltage Standing-Wave Ratio

12. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
BLU6H0410L-600P_6H0410LS-600P#3	20150901	Product data sheet		BLU6H0410L-600P_6H0410LS-600P v.2	
Modifications:	 The format of this document has been redesigned to comply with the new identity guidelines of Ampleon. Legal texts have been adapted to the new company name where appropriate. 				
BLU6H0410L-600P_6H0410LS-600P v.2	20130712	Product data sheet	-	BLU6H0410L-600P_6H0410LS-600P v.1	
BLU6H0410L-600P_6H0410LS-600P v.1	20120426	Product 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.
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Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions"
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BLU6H0410L-600P 6H0410LS-600P#3

BLU6H0410L(S)-600P

Power LDMOS transistor

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BLU6H0410L(S)-600P

Power LDMOS transistor

15. Contents

1	Product profile	. 1
1.1	General description	. 1
1.2	Features and benefits	. 1
1.3	Applications	. 1
2	Pinning information	. 2
3	Ordering information	. 2
4	Limiting values	. 2
5	Thermal characteristics	. 3
6	Characteristics	. 3
6.1	Ruggedness in class-AB operation	. 4
7	Application information	. 5
7.1	Narrowband RF figures	. 5
7.1.1	2-Tone	. 5
7.2	Impedance information	. 5
8	Test information	. 7
9	Package outline	10
10	Handling information	12
11	Abbreviations	
12	Revision history	12
13	Legal information	
13.1	Data sheet status	13
13.2	Definitions	13
13.3	Disclaimers	13
13.4	Trademarks	14
14	Contact information	14
15	Contents	15

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