BLF640

Broadband power LDMOS transistor

Rev. 2 — 11 April 2013 Product data sheet

1. Product profile

1.1 General description

10 W LDMOS power transistor for applications at frequencies from HF to 2200 MHz

Table 1. Typical performance

I_{Dq} = 100 mA; T_{case} = 25 °C in a common source class-AB production test circuit.

Test signal	f (MHz)	V_{DS} (V)	$P_{L(AV)}$ (W)	G_p (dB)	η_D (%)	ACPR (dBc)
2-carrier W-CDMA	2110 to 2170	28	0.7	18.5	15	–50 [1]
1-carrier W-CDMA	2110 to 2170	28	2	19.3	31	–39 [1]

[1] Test signal: 3GPP; test model 1; 64 DPCH; PAR = 7.5 dB at 0.01 % probability on CCDF per carrier; carrier spacing 5 MHz.

1.2 Features and benefits

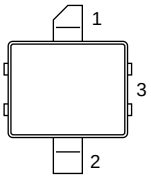
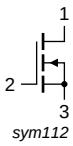
- Easy power control
- Integrated ESD protection
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- No internal matching for broadband operation
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- RF power amplifiers for applications in the HF to 2200 MHz frequency range
- Broadcast drivers

2. Pinning information

Table 2. Pinning

Pin	Description		Simplified outline	Graphic symbol
1	drain			
2	gate			
3	source	[1]		

sym112

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLF640	-	ceramic surface-mounted package; 2 leads	SOT538A

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		-	65	V
V_{GS}	gate-source voltage		–0.5	+13	V
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	225	°C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j\text{-}case)}$	thermal resistance from junction to case	T_{case} = 80 °C; $P_{L(AV)}$ = 11 W	[1]	3.2	K/W

[1] Thermal resistance is determined under specified RF operating conditions

6. Characteristics

Table 6. DC characteristics

T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.5 mA	65	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 18 mA	1.4	1.9	2.4	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	1.5	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	-	3.1	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	150	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 0.9 A	-	0.5	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 0.625 A	-	0.4	-	Ω

Table 7. AC characteristics

T_j = 25 °C unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{rs}	feedback capacitance	V_{GS} = 0 V; V_{DS} = 28 V; f = 1 MHz	-	0.5	-	pF

Table 8. RF characteristics

PAR 7.5 dB at 0.01 % probability on CCDF; 3GPP test model 1; 1-64 PDPCH; RF performance at V_{DS} = 28 V; 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
Test signal: 2-carrier W-CDMA		**f_1 = 2112.5 MHz; f_2 = 2117.5 MHz; f_3 = 2162.5 MHz; f_4 = 2167.5 MHz**				
G_p	power gain	$P_{L(AV)}$ = 0.7 W	-	18.5	-	dB
η_D	drain efficiency	$P_{L(AV)}$ = 0.7 W	-	15	-	%
ACPR	adjacent channel power ratio	$P_{L(AV)}$ = 0.7 W	-	–50	-	dBc
Test signal: 1-carrier W-CDMA		**f_1 = 2112.5 MHz; f_2 = 2167.5 MHz**				
G_p	power gain	$P_{L(AV)}$ = 2 W	17.3	19.3	-	dB
η_D	drain efficiency	$P_{L(AV)}$ = 2 W	29	31	-	%
ACPR	adjacent channel power ratio	$P_{L(AV)}$ = 2 W	-	–39	–36	dBc

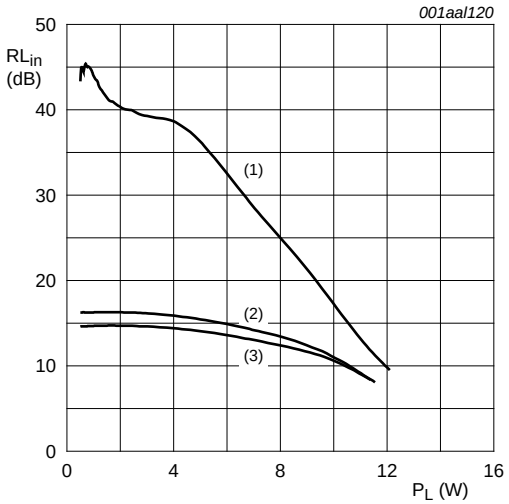
7. Test information

7.1 Ruggedness in class-AB operation

The BLF640 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: V_{DS} = 28 V; f = 2140 MHz at P_L = 10 W.

7.2 Graphical data

7.2.1 CW



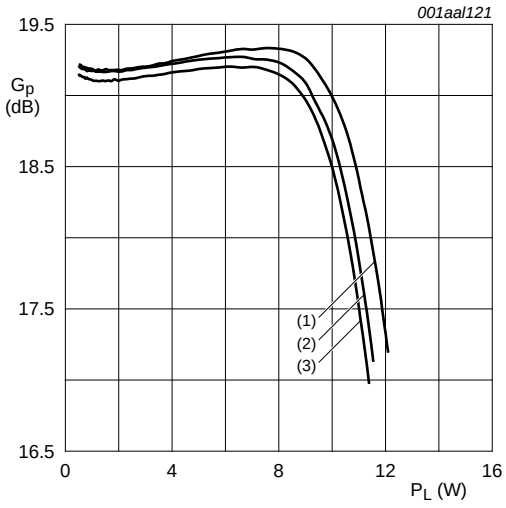
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 1. Input return loss as a function of load power; typical values



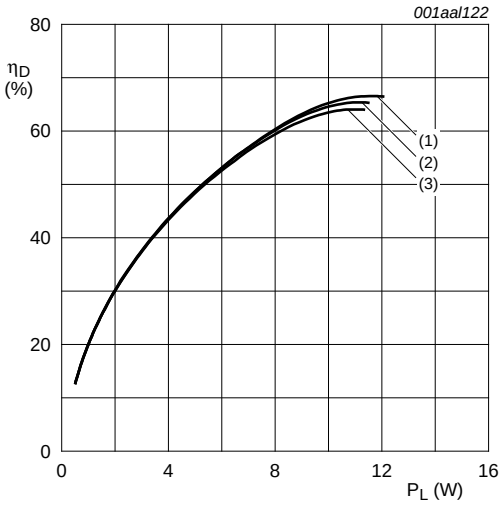
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 2. Power gain as a function of load power; typical values



V_{DS} = 28 V; I_{Dq} = 100 mA.

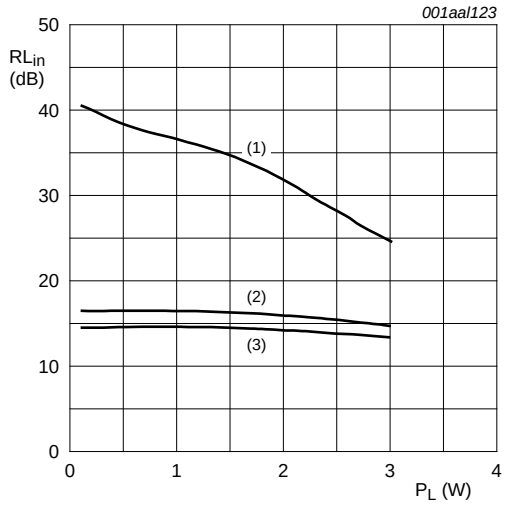
(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 3. Drain efficiency as a function of load power; typical values

7.2.2 1-Carrier W-CDMA



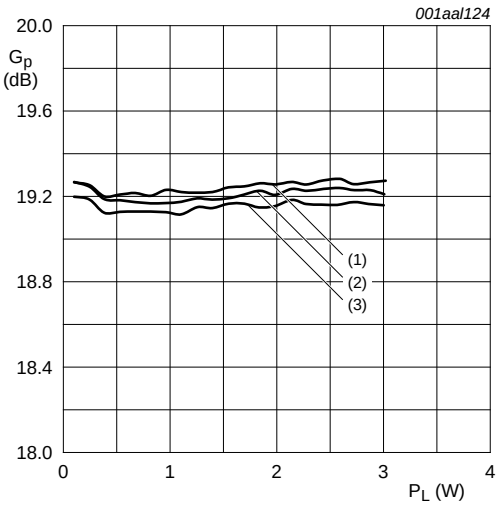
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 4. Input return loss as a function of load power; typical values



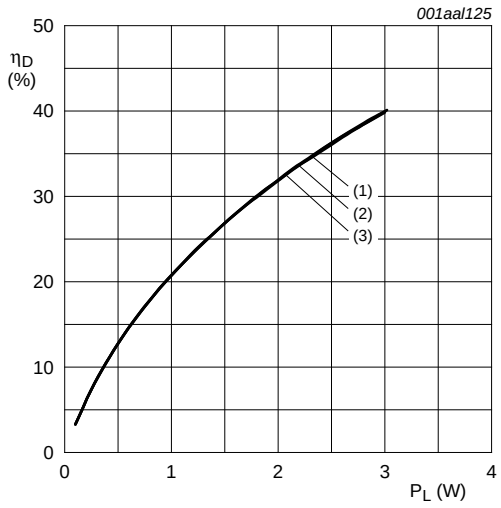
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 5. Power gain as a function of load power; typical values



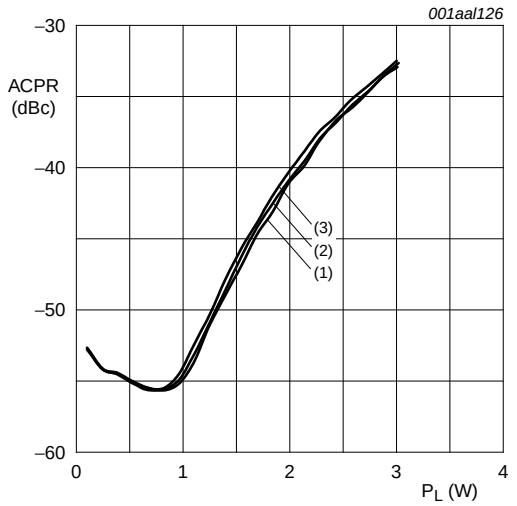
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 6. Drain efficiency as a function of load power; typical values



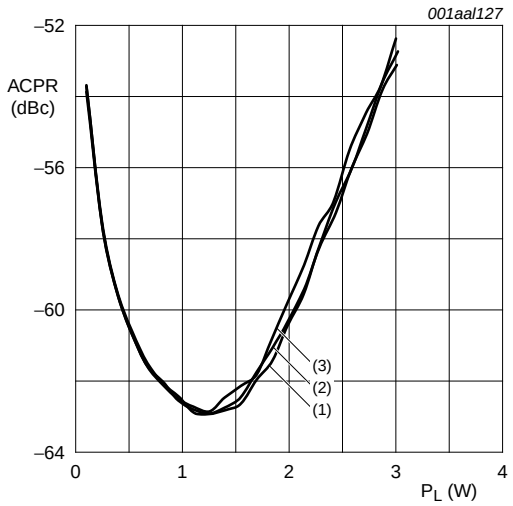
V_{DS} = 28 V; I_{Dq} = 100 mA; carrier spacing 5 MHz.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 7. Adjacent channel power ratio as a function of load power; typical values



V_{DS} = 28 V; I_{Dq} = 100 mA; carrier spacing 10 MHz.

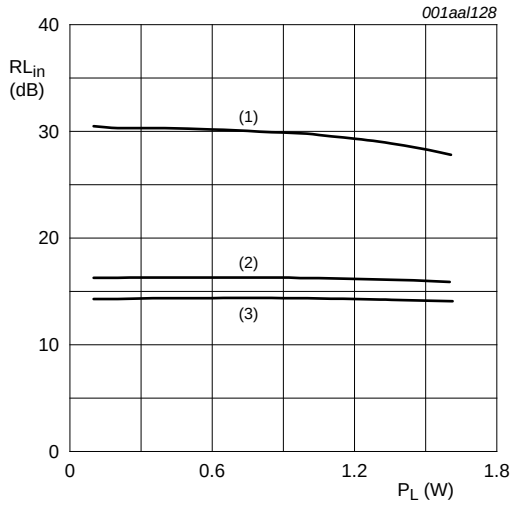
(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 8. Adjacent channel power ratio as a function of load power; typical values

7.2.3 2-Carrier W-CDMA



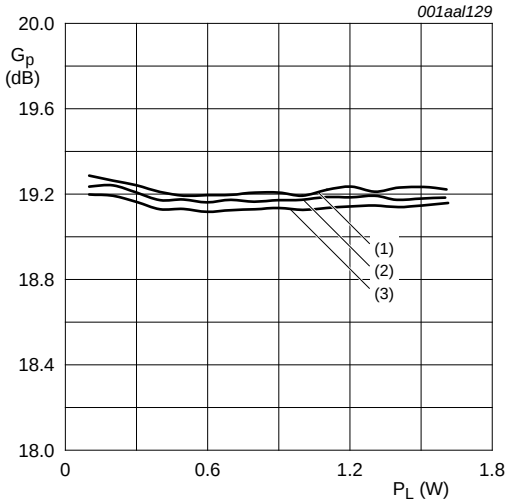
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 9. Input return loss as a function of load power; typical values



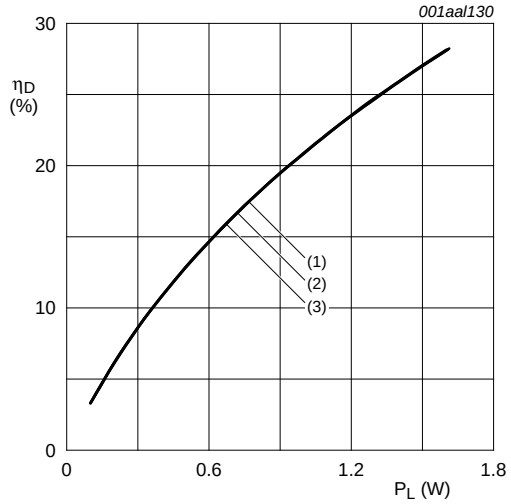
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 10. Power gain as a function of load power; typical values



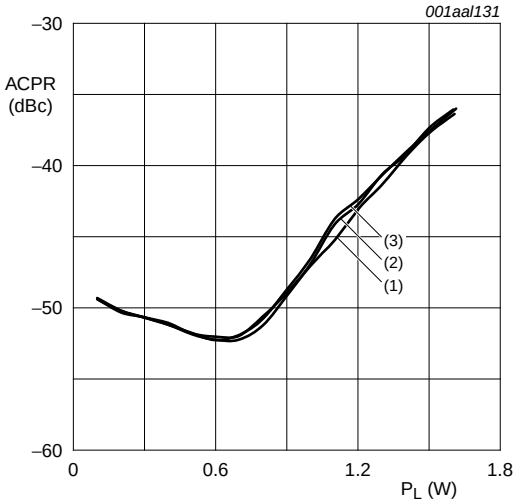
V_{DS} = 28 V; I_{Dq} = 100 mA.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 11. Drain efficiency as a function of load power; typical values



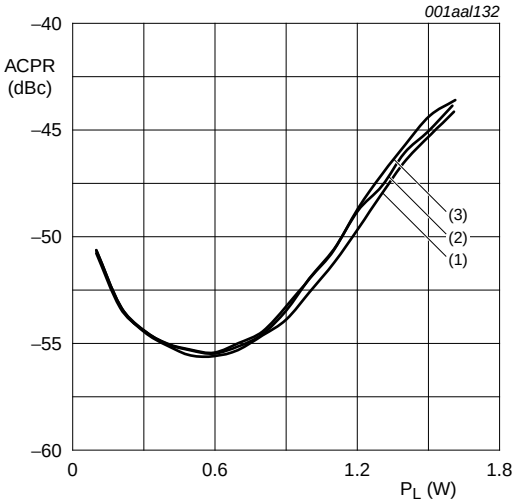
V_{DS} = 28 V; I_{Dq} = 100 mA; carrier spacing 5 MHz.

(1) f = 2.11 GHz

(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 12. Adjacent channel power ratio as a function of load power; typical values



V_{DS} = 28 V; I_{Dq} = 100 mA; carrier spacing 10 MHz.

(1) f = 2.11 GHz

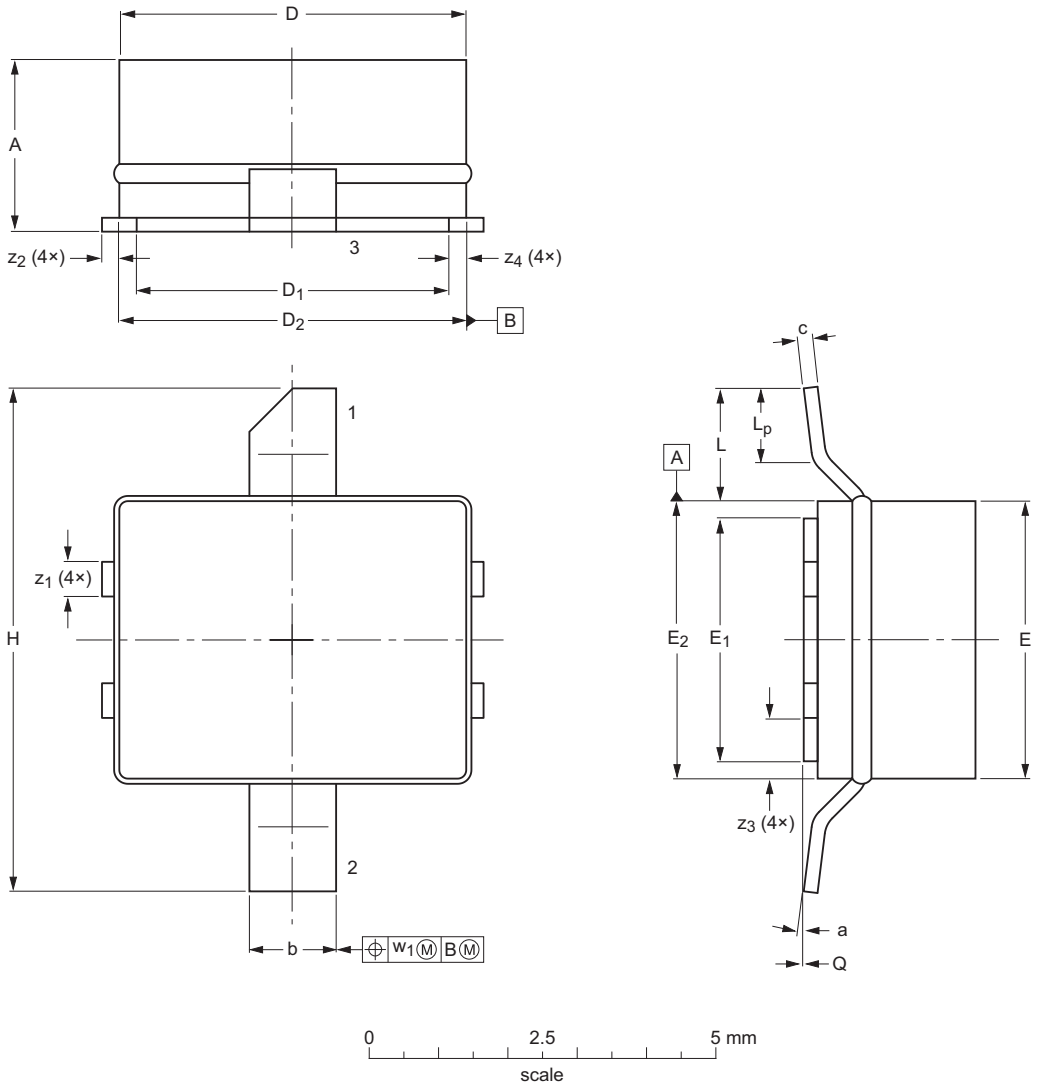
(2) f = 2.14 GHz

(3) f = 2.17 GHz

Fig 13. Adjacent channel power ratio as a function of load power; typical values

8. Package outline

Ceramic surface-mounted package; 2 leads **SOT538A**



Dimensions (mm are the original dimensions)

Unit		A	b	c	D	D_1	D_2	E	E_1	E_2	H	L	L_p	Q	w_1	z_1	z_2	z_3	z_4	θ
mm	max	2.34	1.35	0.23	5.16	4.65	5.16	4.14	3.63	4.14	7.49	2.03	1.02	0.1		0.58	0.25	0.97	0.51	7°
	nom														0.25					
	min	2.13	1.19	0.18	5.00	4.50	5.00	3.99	3.48	3.99	7.24	1.27	0.51	0.0		0.43	0.18	0.81	0.00	0°

sot538a_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT538A						~~06-03-16~~ 13-02-07

Fig 14. Package outline SOT538A

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 9. Abbreviations

Acronym	Description
3GPP	3rd Generation Partnership Project
CCDF	Complementary Cumulative Distribution Function
CW	Continuous Wave
DPCH	Dedicated Physical CHannel
ESD	ElectroStatic Discharge
HF	High Frequency
LDMOS	Laterally Diffused Metal Oxide Semiconductor
PAR	Peak-to-Average Ratio
PDPCH	transmission Power of the Dedicated Physical CHannel
PHS	Personal Handy-phone System
VSWR	Voltage Standing Wave Ratio
W-CDMA	Wideband Code Division Multiple Access

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLF640 v.2	20130411	Product data sheet	-	BLF640 v.1
Modifications:	• Package outline drawings have been updated to the latest version.			
BLF640 v.1	20121207	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.nxp.com.

12.2 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. NXP Semiconductors 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 NXP Semiconductors 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 NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

12.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors 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. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors 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, NXP Semiconductors' 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 NXP Semiconductors.

Right to make changes — NXP Semiconductors 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 — NXP Semiconductors 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 NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors 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. NXP Semiconductors 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 NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors 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.

NXP Semiconductors 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 NXP Semiconductors 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). NXP 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 — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/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. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors 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 NXP Semiconductors 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. NXP Semiconductors 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 NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' 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.

12.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

13. Contact information

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

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

14. Contents

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 11 April 2013
Document identifier: BLF640