BLS6G2731S-130

LDMOS S-band radar power transistor

Rev. 2 — 18 November 2010 Product data sheet

1. Product profile

1.1 General description

130 W LDMOS power transistor intended for radar applications in the 2.7 GHz to 3.1 GHz range.

Table 1. Typical performance

Typical RF performance at T_{case} = 25 °C; t_p = 300 μs; δ = 10 %; I_{Dq} = 100 mA; in a class-AB production test circuit.

Mode of operation	f (GHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)	t_r (ns)	t_f (ns)
pulsed RF	2.7 to 3.1	32	130	12	50	20	6

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features and benefits

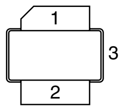
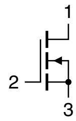
- Typical pulsed RF performance at a frequency of 2.7 GHz to 3.1 GHz, a supply voltage of 32 V, an I_{Dq} of 100 mA, a t_p of 300 μs with δ of 10 %:
  - Output power = 130 W
  - Power gain = 12 dB
  - Efficiency = 50 %
- Easy power control
- Integrated ESD protection
- High flexibility with respect to pulse formats
- Excellent ruggedness
- High efficiency
- Excellent thermal stability
- Designed for broadband operation (2.7 GHz to 3.1 GHz)
- Internally matched for ease of use
- Compliant to Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC

1.3 Applications

- S-band power amplifiers for radar applications in the 2.7 GHz to 3.1 GHz frequency range

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	drain		 sym112
2	gate		
3	source [1]		

[1] Connected to flange.

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BLS6G2731S-130	-	ceramic earless flanged cavity package; 2 leads	SOT922-1

4. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Min	Max	Unit
V_{DS}	drain-source voltage	-	60	V
V_{GS}	gate-source voltage	–0.5	+13	V
I_D	drain current	-	33	A
T_{stg}	storage temperature	–65	+150	°C
T_j	junction temperature	-	200	°C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$Z_{th(j-mb)}$	transient thermal impedance from junction to mounting base	T_{case} = 85 °C; P_L = 130 W		
		t_p = 100 μs; δ = 10 %	0.23	K/W
		t_p = 200 μs; δ = 10 %	0.28	K/W
		t_p = 300 μs; δ = 10 %	0.32	K/W
		t_p = 100 μs; δ = 20 %	0.33	K/W

6. Characteristics

Table 6. 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 = 0.6 mA	60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	V_{DS} = 10 V; I_D = 180 mA	1.4	1.8	2.4	V
I_{DSS}	drain leakage current	V_{GS} = 0 V; V_{DS} = 28 V	-	-	4.2	μA
I_{DSX}	drain cut-off current	V_{GS} = $V_{GS(th)}$ + 3.75 V; V_{DS} = 10 V	27	33	-	A
I_{GSS}	gate leakage current	V_{GS} = 11 V; V_{DS} = 0 V	-	-	450	nA
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 9 A	8.1	13	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = $V_{GS(th)}$ + 3.75 V; I_D = 6.3 A	-	0.085	0.135	Ω

7. Application information

Table 7. Application information

Mode of operation: pulsed RF; t_p = 300 μs; δ = 10 %; RF performance at V_{DS} = 32 V; I_{Dq} = 100 mA; T_{case} = 25 °C; unless otherwise specified, in a class-AB production circuit.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_L	output power		-	130	-	W
V_{DD}	supply voltage	P_L = 130 W	-	-	32	V
G_p	power gain	P_L = 130 W	10	12	-	dB
RL_{in}	input return loss	P_L = 130 W	5.5	8	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression		-	140	-	W
η_D	drain efficiency	P_L = 130 W	45	50	-	%
$P_{droop(pulse)}$	pulse droop power	P_L = 130 W	-	0	0.25	dB
t_r	rise time	P_L = 130 W	-	20	50	ns
t_f	fall time	P_L = 130 W	-	6	50	ns

Table 8. Typical impedance

f (GHz)	Z_S (Ω)	Z_L (Ω)
2.7	3.2 – j6.5	4.5 – j3.6
2.8	4.4 – j6.2	3.5 – j3.8
2.9	5.6 – j7.3	3.7 – j3.1
3.0	4.9 – j9.2	3.0 – j3.3
3.1	3 – j9.5	2.8 – j3.6

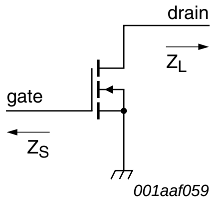
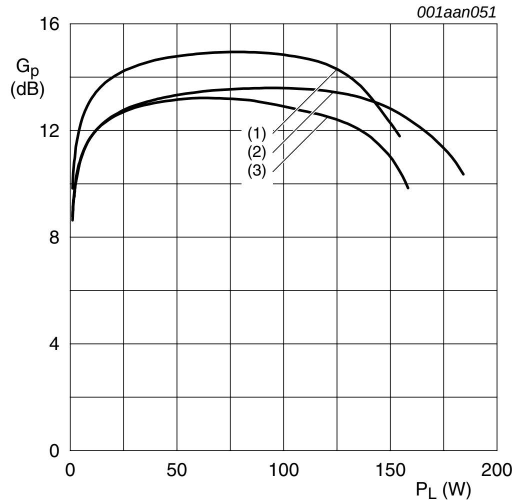


Fig 1. Definition of transistor impedance

7.1 Ruggedness in class-AB operation

The BLS6G2731S-130 is capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions: V_{DS} = 32 V; I_{Dq} = 100 mA; P_L = 130 W; t_p = 300 μs; δ = 10 %.

7.2 Graphs



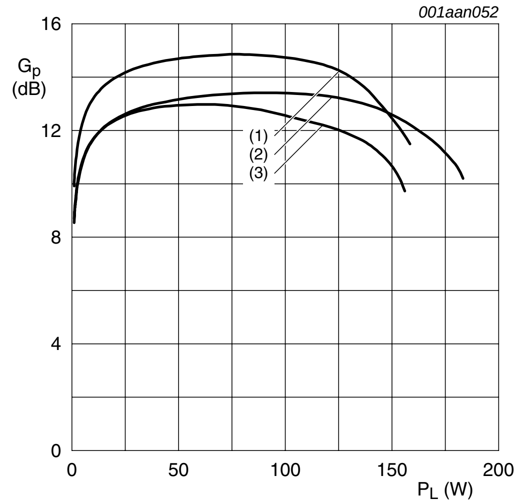
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 300 μs; δ = 10 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

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



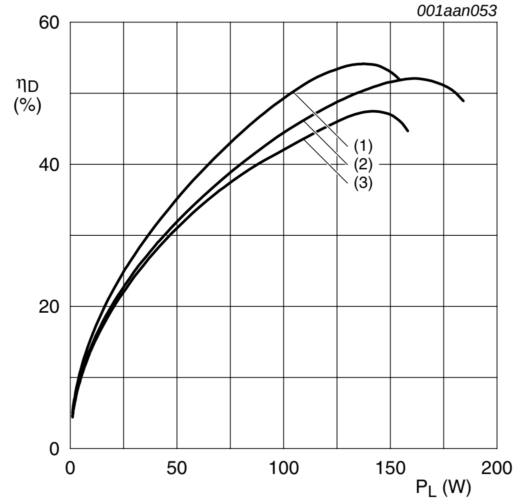
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 100 μs; δ = 20 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

Fig 3. Power gain as a function of load power; typical values



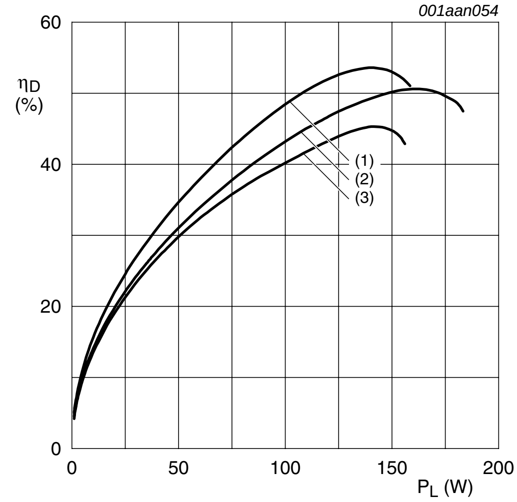
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 300 μs; δ = 10 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

Fig 4. Drain efficiency as a function of load power; typical values



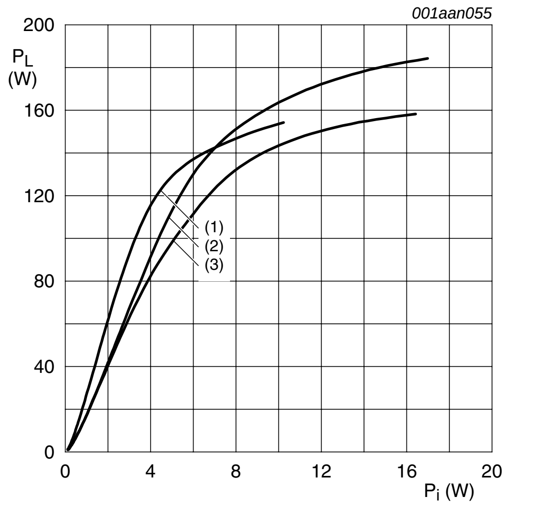
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 100 μs; δ = 20 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

Fig 5. Drain efficiency as a function of load power; typical values



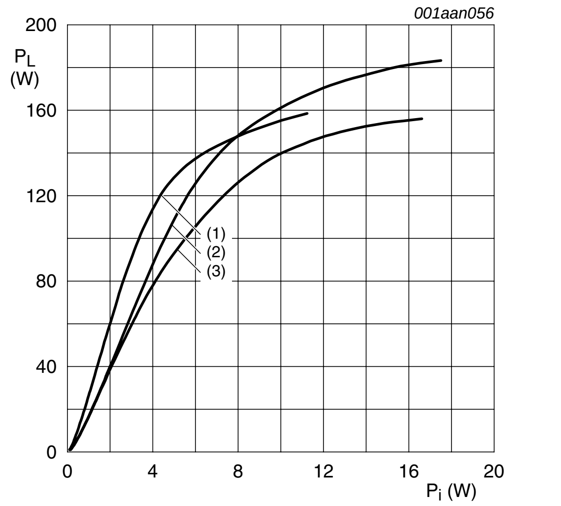
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 300 μs; δ = 10 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

(3) f = 3.1 GHz

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



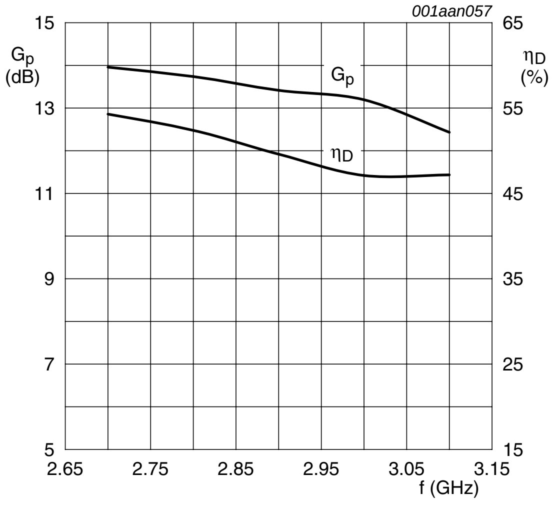
V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 100 μs; δ = 20 %.

(1) f = 2.7 GHz

(2) f = 2.9 GHz

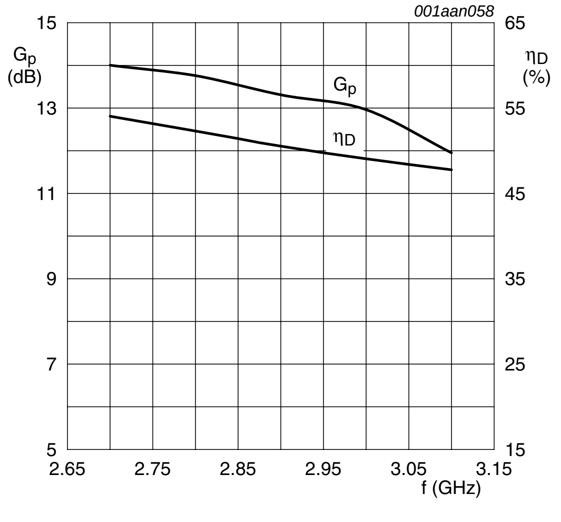
(3) f = 3.1 GHz

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



P_L = 130 W; V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 300 μs; δ = 10 %.

Fig 8. Power gain and drain efficiency as function of frequency; typical values



P_L = 130 W; V_{DS} = 32 V; I_{Dq} = 100 mA; t_p = 100 μs; δ = 20 %.

Fig 9. Power gain and drain efficiency as function of frequency; typical values

8. Test information

Table 9. List of components

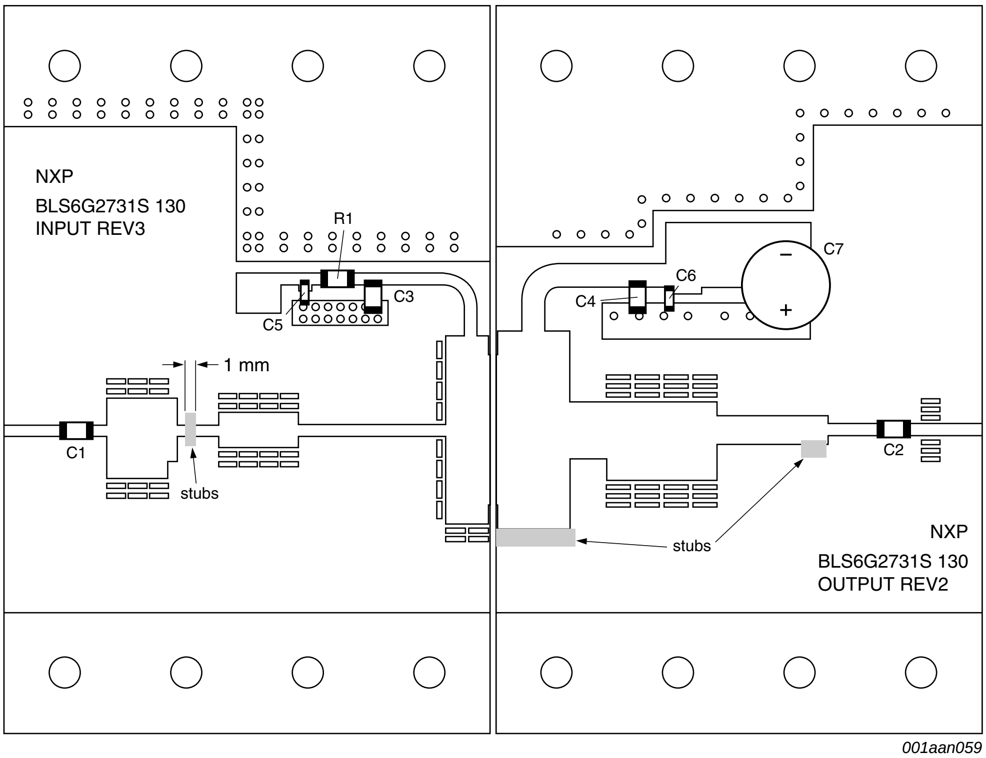
Printed-Circuit Board (PCB): Rogers Duroid 6006; thickness = 0.64 mm; ε_r = 6.15; thickness of copper plating = 0.035 mm.

For test circuit see Figure 10.

Component	Description	Value	Remarks
C1, C2, C3, C4	multilayer ceramic chip capacitor	20 pF	[1]
C5, C6	multilayer ceramic chip capacitor	1 nF	[2]
C7	electrolytic capacitor	470 μF; 63 V	
R1	SMD resistor	10 Ω	

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

[2] American Technical Ceramics type 700A or capacitor of same quality.



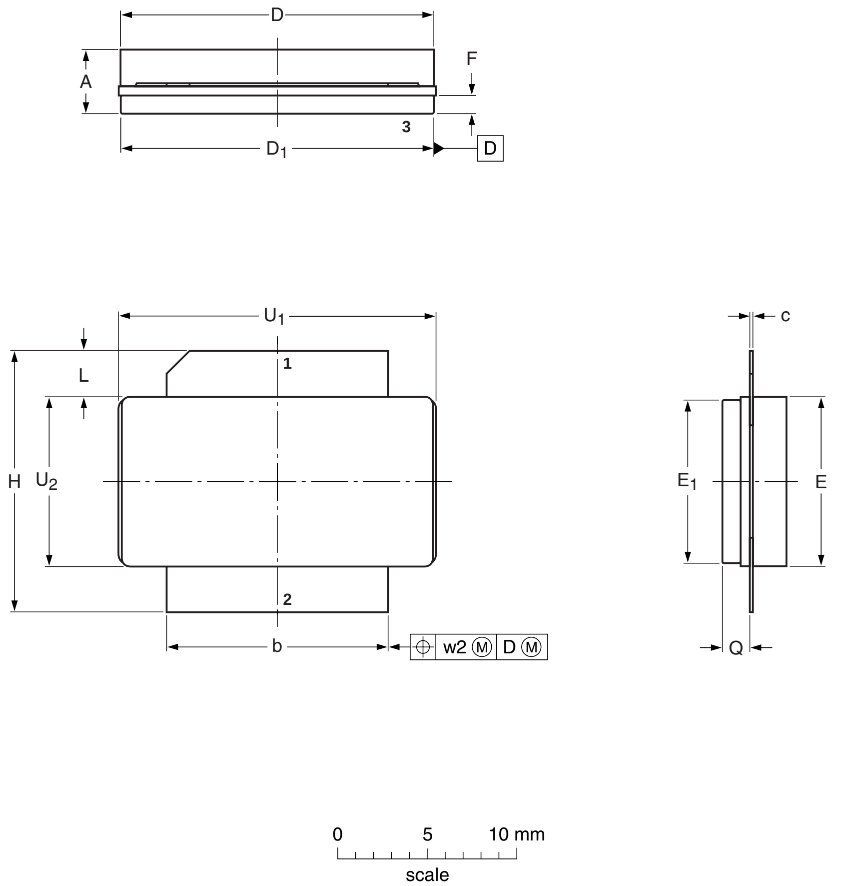
Printed-Circuit Board (PCB): Rogers Duroid 6006; thickness = 0.64 mm; ε_r = 6.15; thickness of copper plating = 0.035 mm.

See Table 9 for a list of components.

Fig 10. Component layout for test circuit

9. Package outline

Ceramic earless flanged cavity package; 2 leads **SOT922-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	L	Q	U_1	U_2	w_2
mm	4.22 3.53	12.42 12.17	0.15 0.10	17.58 17.22	17.50 17.25	9.53 9.27	9.27 9.02	1.32 0.81	15.62 14.34	3.05 2.03	1.70 1.45	17.75 17.50	9.53 9.27	0.25
inches	0.166 0.139	0.489 0.479	0.006 0.004	0.692 0.678	0.689 0.679	0.375 0.365	0.365 0.355	0.052 0.032	0.615 0.525	0.12 0.08	0.067 0.057	0.699 0.689	0.375 0.365	0.010

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT922-1						~~05-11-14~~ 05-11-22

Fig 11. Package outline SOT922-1

10. Abbreviations

Table 10. Abbreviations

Acronym	Description
LDMOS	Laterally Diffused Metal-Oxide Semiconductor
RF	Radio Frequency
VSWR	Voltage Standing-Wave Ratio

11. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BLS6G2731S-130 v.2	20101118	Product data sheet	-	BLS6G2731S-130 v.1
Modifications:	• Table 1 on page 1: Some values have been changed. • Section 1.2 on page 1: The value of G_p has been changed. • Table 7 on page 3: Some values have been changed. • Table 8 on page 4: Values have been entered. • Section 7.2 on page 5: Section with graphs has been added. • Section 8 on page 7: Test information has been added.			
BLS6G2731S-130 v.1	20100726	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.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.

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 accepts 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 national 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.

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: 18 November 2010
Document identifier: BLS6G2731S-130