

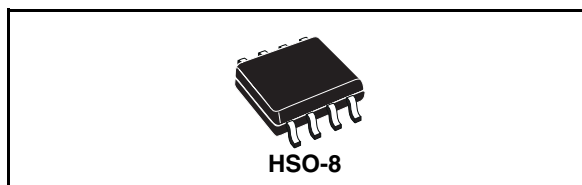
High performance 2A ULDO linear regulator

Features

- 2V to 14V input voltage range
- 200mΩ $r_{DS(on)}$ max
- 200μA quiescent current at any load
- Excellent load and line regulation
- Adjustable from 1.2V to 5V
- 1% voltage regulation accuracy
- Short circuit protection
- Thermal shut down
- HSOP8 package

Applications

- Motherboards
- Mobile PC
- Hand-held instruments
- PCMCIA Cards
- Processors I/O
- Chipset and RAM supply



Description

The L6932 Ultra Low Drop Output linear regulator operates from 2V to 14V and is able to support output current up to 2A. Designed with an internal 50mΩ N-channel Mosfet, it can be used for onboard DC-DC conversions saving in real estate, list of components, low noise generation and power dissipation.

L6932H1.2 is available as adjustable version from 1.2V to 5V with a voltage regulation accuracy of 1%.

The upper current limit is fixed at 2.5A to control the current in short circuit condition within $\pm 8\%$. The current is sensed in the power mos in order to limit the power dissipation.

The device is also provided with a thermal shut down that limits the internal temperature at 150°C with a hysteresys of 20°C. L6932H1.2 provides the Enable and the Power good functions.

Figure 1. Typical operating circuit

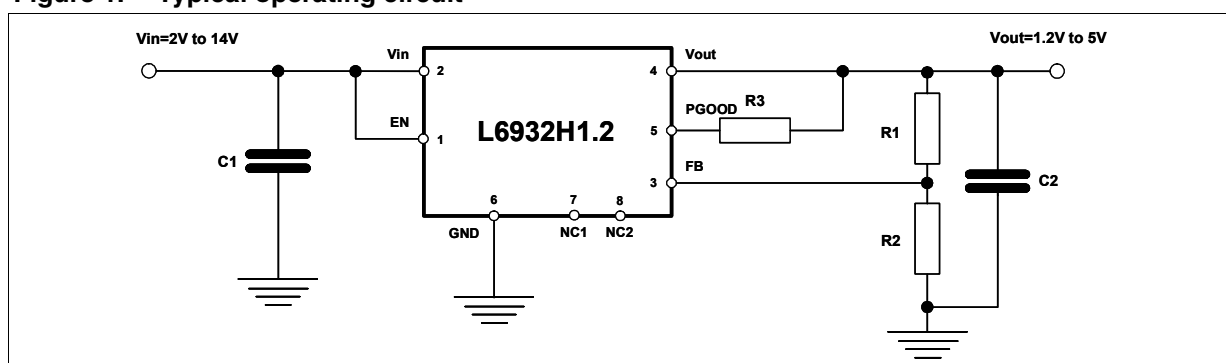


Table 1. Device summary

Part number	Package	Packaging
L6932H1.2	HSO-8	Tube
L6932H1.2TR	HSO-8	Tape and reel

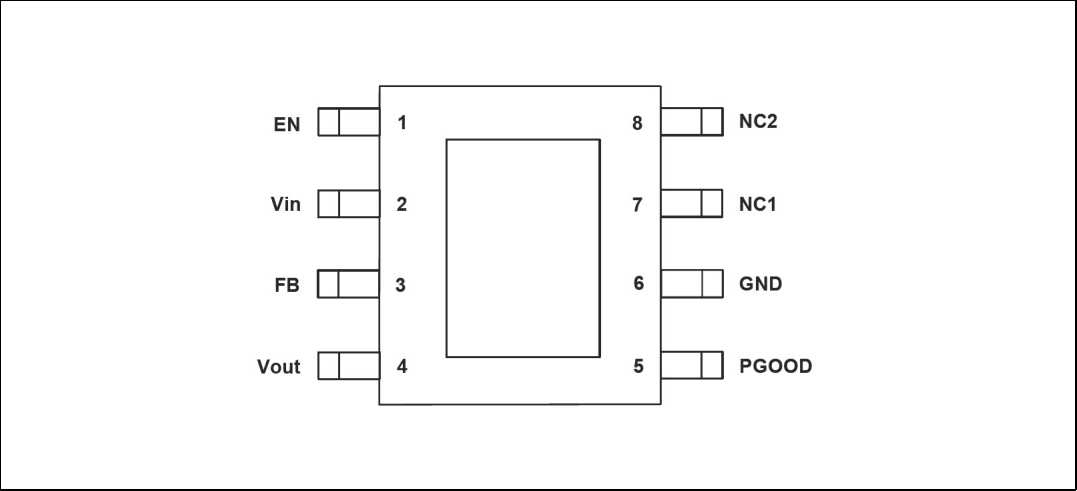
Contents

1	Pin settings	3
1.1	Pin connection	3
1.2	Pin description	3
2	Maximum ratings	4
2.1	Absolute maximum ratings	4
2.2	Thermal data	4
3	Block diagram	4
4	Electrical characteristics	5
5	Typical electrical performance	6
6	Application informations	7
6.1	Application circuit	7
6.2	Demoboard layout	7
6.3	Component part list	8
7	Components selection	8
7.1	Input capacitor	8
7.2	Output capacitor	8
7.3	Loop Stability	9
8	Package mechanical data	10
9	Revision history	12

1 Pin settings

1.1 Pin connection

Figure 2. Pin connection (top view)



1.2 Pin description

Table 2. Pin description

Name	Pin N°	Description
1	EN	Enables the device when connected to Vin and disables it when forced to GND.
2	VIN	Supply voltage. This pin is connected to the drain of the internal N-mos. Connect this pin to a capacitor larger than 10μF.
3	FB	Connecting this pin to a voltage divider it is possible to program the output voltage between 1.2V and 5V.
4	VOOUT	Regulated output voltage. This pin is connected to the source of the internal N-mos. Connect this pin to a capacitor of 10μF.
5	PGOOD	Power good output. The pin is open drain and detects the output voltage. It is forced low if the output voltage is lower than 90% of the programmed voltage.
6	GND	Ground pin
7, 8	NC1-NC2	Internally not connected.

2 Maximum ratings

2.1 Absolute maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	VIN and PGOOD	14.5	V
	EN, OUT and ADJ	-0.3 to (Vin +0.3)	V

2.2 Thermal data

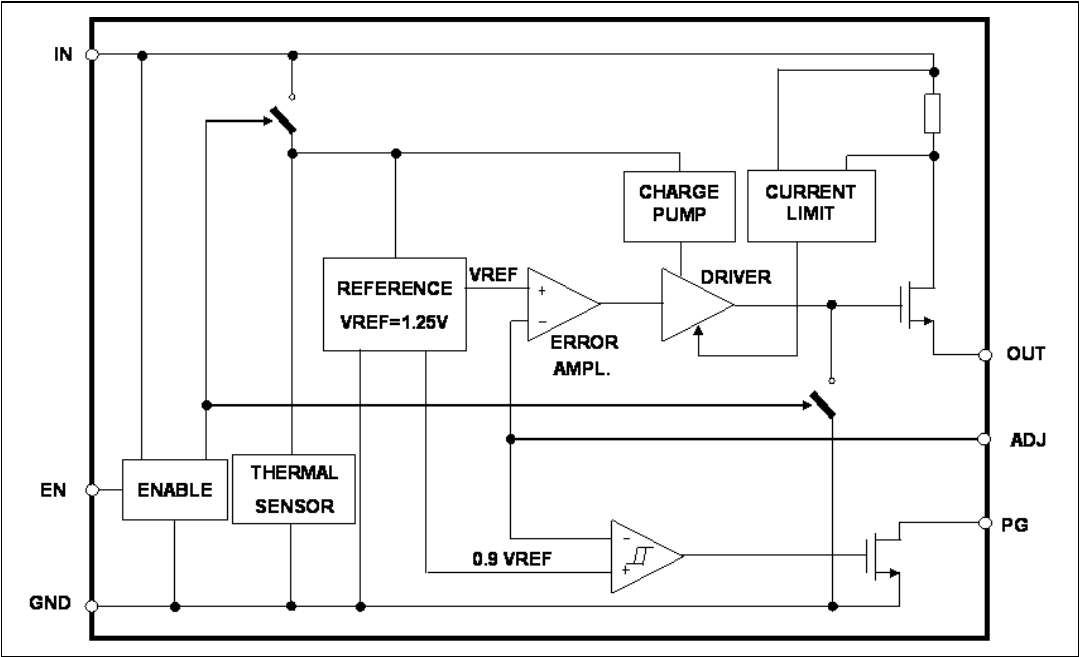
Table 4. Thermal data

Symbol	Parameter	Value	Unit
R_{thJA}	Maximum thermal resistance junction-ambient	34 ⁽¹⁾	°C/W
T_{MAX}	Maximum junction temperature	150	°C
T_{STG}	Storage temperature range	-65 to 150	°C

1. Package mounted on board

3 Block diagram

Figure 3. Internal block diagram



4 Electrical characteristics

Table 5. Electrical characteristics ($T_J = 25^\circ\text{C}$, $V_{IN} = 5\text{V}$ unless otherwise specified)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
V_{IN}	Operating Supply Voltage		2		14	V
V_O	Output voltage	$I_O = 0.1\text{A}$; $V_{IN} = 3.3\text{V}$	1.188	1.2	1.212	V
	Line Regulation	$V_{IN} = 2.5\text{V} \pm 10\%$; $I_O = 10\text{mA}$			5	mV
		$V_{IN} = 3.3\text{V} \pm 10\%$; $I_O = 10\text{mA}$			5	mV
		$V_{IN} = 5\text{V} \pm 10\%$; $I_O = 10\text{mA}$			5	mV
	Load Regulation	$V_{IN} = 3.3\text{V}$; $0.1\text{A} < I_O < 2\text{A}$			15	mV
$r_{DS(on)}$	Drain Source ON resistance				200	$\text{m}\Omega$
I_{OCC}	Current limiting		2.3	2.5	2.7	A
I_q	Quiescent current			0.2	0.4	mA
I_{sh}	Shutdown current	$2\text{V} < V_{IN} < 14\text{V}$ ⁽¹⁾			25	μA
	Ripple Rejection	$f = 120\text{Hz}$, $I_O = 1\text{A}$, $V_{IN} = 5\text{V}$, $\Delta V_{IN} = 2\text{V}_{pp}$	60	75		dB
V_{en}	EN Input Threshold		0.5	0.65	0.8	V
	Pgood threshold	V_O rise		90		% V_O
	Pgood Hysteresis			10		% V_O
	Pgood saturation	$I_{pgood} = 1\text{mA}$		0.2	0.4	V

1. Specification referred to T from -25°C to 125°C .

5 Typical electrical performance

Figure 4. Output voltage vs junction temperature

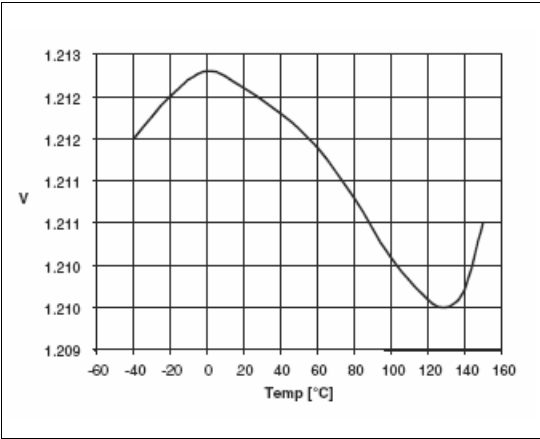


Figure 5. Quiescent current vs junction temperature

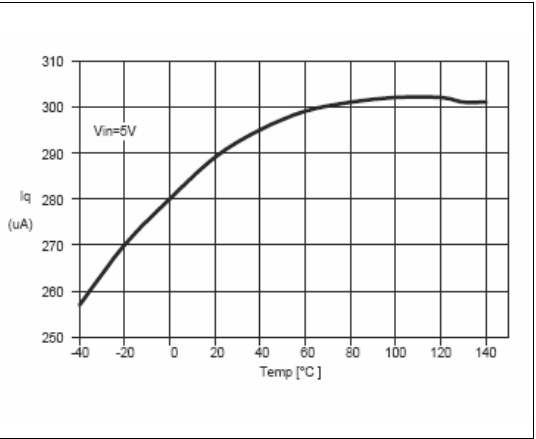
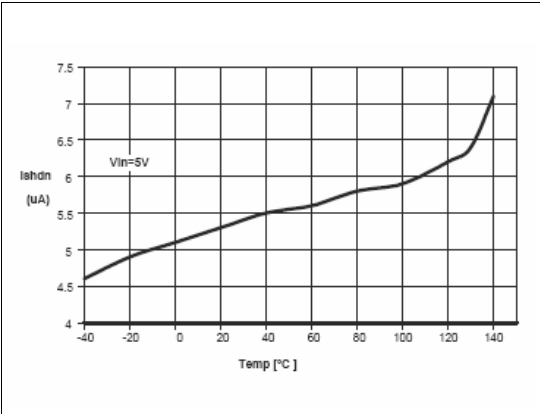


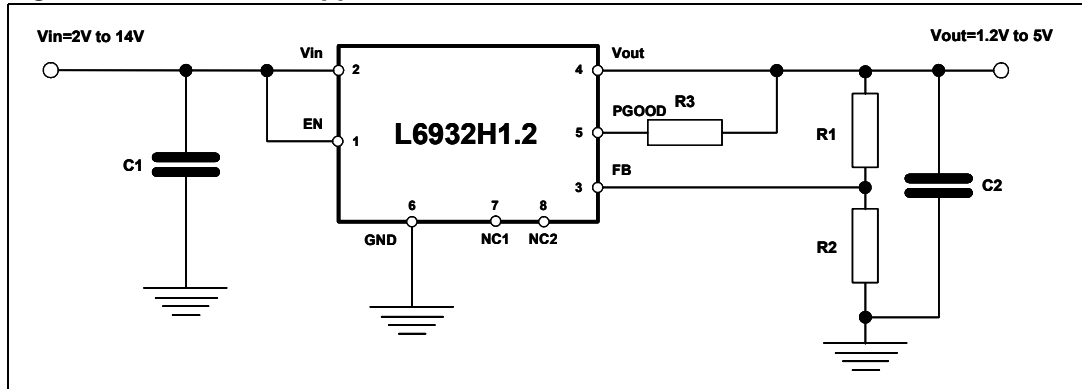
Figure 6. Shutdown current vs junction temperature



6 Application information

6.1 Application circuit

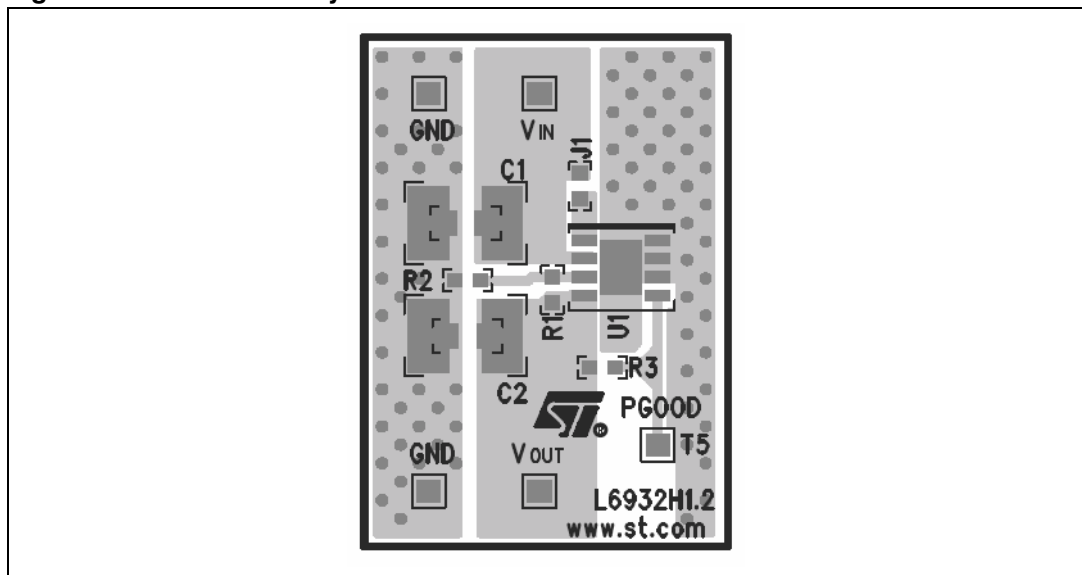
Figure 7. Demoboard application circuit



$$V_{OUT} = \frac{1.2}{R_2} \times (R_1 + R_2)$$

6.2 Demoboard layout

Figure 8. Demoboard layout



6.3 Component part list

Table 6. Component par list

Reference	Part number	Description	Manufacturer
C1	GRM32ER6C226KE20B	22Uf, 16V	MURATA
C2	GRM32ER6C226KE20B	22Uf, 16V	MURATA
R1		N.M.	
R2		0Ω	
R3		100K	

7 Components selection

7.1 Input capacitor

The input capacitor value depends on a lot of factors such as load transient requirements, input source (battery or DC/DC converter) and its distance from the input cap. Usually a 47μF is enough for any application but a much lower value can be sufficient in many cases.

7.2 Output capacitor

The output capacitor choice depends basically on the load transient requirements. Tantalum, Special Polymer, POSCAP and aluminum capacitors are good and offer very low ESR values. Multilayer ceramic caps have the lowest ESR and can be required for particular applications. Nevertheless in several applications they are ok, the loop stability issue has to be considered (see loop stability section).

Below a list of some suggested capacitor manufacturers

Table 7. Suggested capacitor

Manufacturer	Type	Cap Value (μF)	Rated Voltage (V)
MURATA	CERAMIC	1 to 47	4 to 16
PANASONIC	CERAMIC	1 to 47	4 to 16
TAYO YUDEN	CERAMIC	1 to 47	4 to 16
TDK	CERAMIC	1 to 47	4 to 16
TOKIN	CERAMIC	1 to 47	4 to 16
SANYO	POSCAP	1 to 47	4 to 16
PANASONIC	SP	1 to 47	4 to 16
KEMET	TANTALUM	1 to 47	4 to 16

7.3 Loop Stability

The stability of the loop is affected by the zero introduced by the output capacitor. The time constant of the zero is given by:

$$T = ESR \times C_{OUT}$$

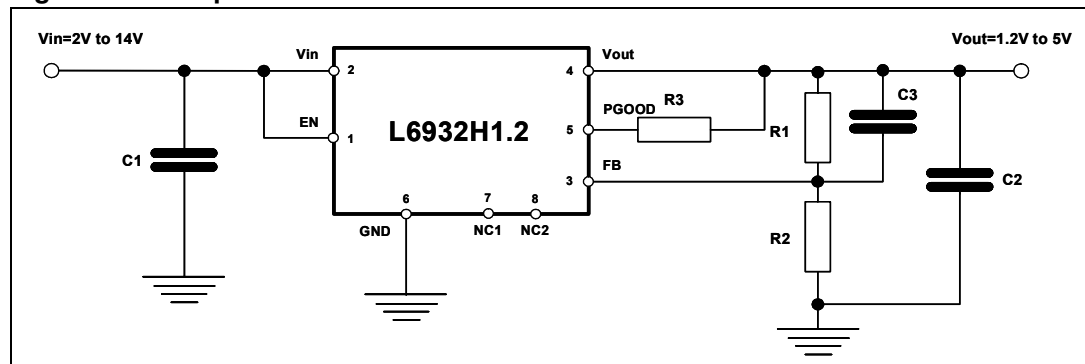
$$F_{ZERP} = \frac{1}{2\pi \times ESR \times C_{OUT}}$$

This zero helps to increase the phase margin of the loop until the time constant is higher than some hundreds of nsec, depending also on the output voltage and current.

So, using very low ESR ceramic capacitors could produce oscillations at the output, in particular when regulating high output voltages (adjustable version).

To solve this issue is sufficient to add a small capacitor (e.g. 1nF to 10nF) in parallel to the high side resistor of the external divider, as shown in [Figure 9](#).

Figure 9. Compensation network



The thermal resistance junction to ambient of the demoboard is approximately 34°C/W.

This means that, considering an ambient temperature of 60°C and, a maximum junction temperature of 150°C, the maximum power that the device can handle is 2.7W.

This means that the device is able to deliver a DC output current of 2A only with a very low dropout.

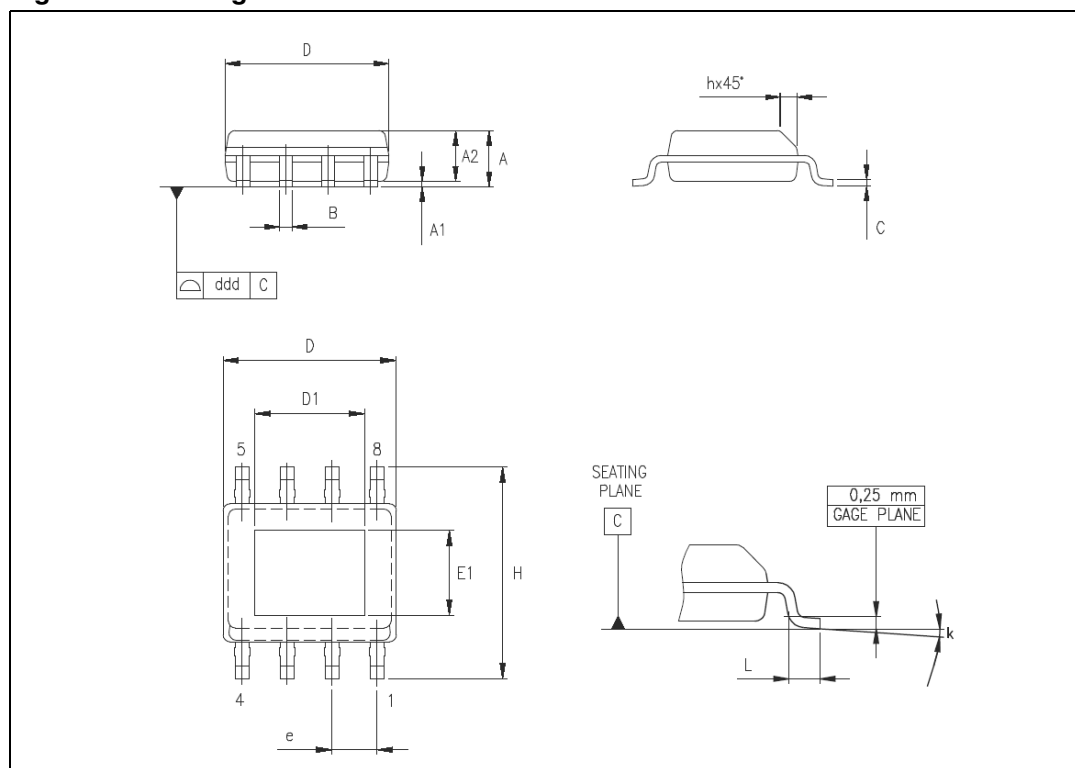
8 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

Table 8. HSO-8 Mechanical data

Dim.	mm.			inch		
	Min	Typ	Max	Min	Typ	Max
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
D1		3.1			0.122	
E	3.80		4.00	0.150		0.157
E1		2.4			0.094	
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04

Figure 10. Package dimensions



9 Revision history

Table 9. Revision history

Date	Revision	Changes
23-Jun-2006	1	First release
07-May-2007	2	Final release, mechanical data pad size updated

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2007 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com