

Ultrafast recovery diode

Features

- Negligible switching losses
- Low forward and reverse recovery times
- High junction temperature

Description

The STTH1R04 series uses ST's new 400 V planar Pt doping technology. The STTH1R04 is specially suited for switching mode base drive and transistor circuits.

Packaged in axial and surface mount packages, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection.

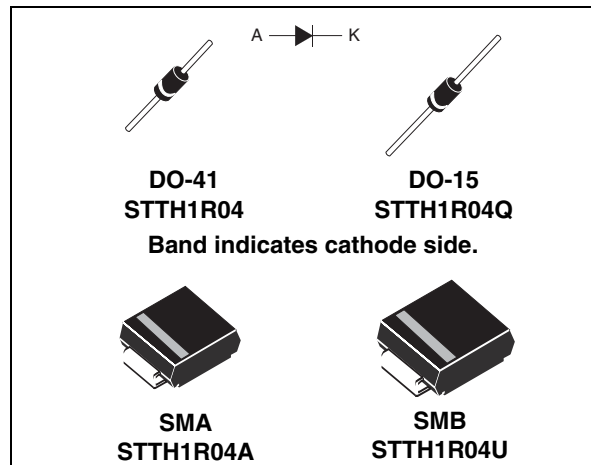


Table 1. Device summary

$I_{F(AV)}$	1 A
V_{RRM}	400 V
$T_j (max)$	175 °C
$V_F (typ)$	0.9 V
$t_{rr} (typ)$	14 ns

1 Characteristics

Table 2. Absolute ratings (limiting values at 25 °C, unless otherwise specified)

Symbol	Parameter		Value	Unit	
V_{RRM}	Repetitive peak reverse voltage		400	V	
$I_{F(AV)}$	Average forward current, $\delta = 0.5$	DO-41	$T_{lead} = 100\text{ °C}$	1.0	A
		DO-15	$T_{lead} = 105\text{ °C}$		
		SMA	$T_{lead} = 125\text{ °C}$		
		SMB	$T_{lead} = 140\text{ °C}$		
I_{FSM}	Surge non repetitive forward current	$t_p = 10\text{ ms}$ Sinusoidal	30	A	
T_{stg}	Storage temperature range		-65 to +175	°C	
T_j	Maximum operating junction temperature ⁽¹⁾		175	°C	

1. On infinite heatsink with 10 mm lead length

Table 3. Thermal parameters

Symbol	Parameter		Value	Unit	
$R_{th(j-l)}$	Junction to lead	Lead length = 10 mm on infinite heatsink	DO-41	55	°C/W
			DO-15	50	
$R_{th(j-l)}$	Junction to lead	SMA	35		
		SMB	25		

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions		Min	Typ	Max	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$			5	μA
		$T_j = 125\text{ °C}$			5	50	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 1.0\text{ A}$			1.5	V
		$T_j = 100\text{ °C}$			1.0	1.25	
		$T_j = 150\text{ °C}$			0.9	1.15	

1. Pulse test: $t_p = 5\text{ ms}$, $\delta < 2\%$

2. Pulse test: $t_p = 380\text{ }\mu\text{s}$, $\delta < 2\%$

To evaluate the conduction losses use the following equation:

$$P = 0.9 \times I_{F(AV)} + 0.250 \times I_{F(RMS)}^2$$

Table 5. Dynamic characteristics ($T_j = 25\text{ }^\circ\text{C}$ unless otherwise stated)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{rr}	Reverse recovery time	$I_F = 1\text{ A}$, $di_F/dt = -50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$			30	ns
		$I_F = 1\text{ A}$, $di_F/dt = -100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$		14	20	
I_{RM}	Reverse recovery current	$I_F = 1\text{ A}$, $di_F/dt = -200\text{ A}/\mu\text{s}$, $V_R = 320\text{ V}$, $T_j = 125\text{ }^\circ\text{C}$		2.5	3.5	A
t_{fr}	Forward recovery time	$I_F = 1\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$, $T_j = 25\text{ }^\circ\text{C}$			50	ns
V_{FP}	Forward recovery voltage	$I_F = 1\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$		3.5		V

Figure 1. Conduction losses versus average forward current

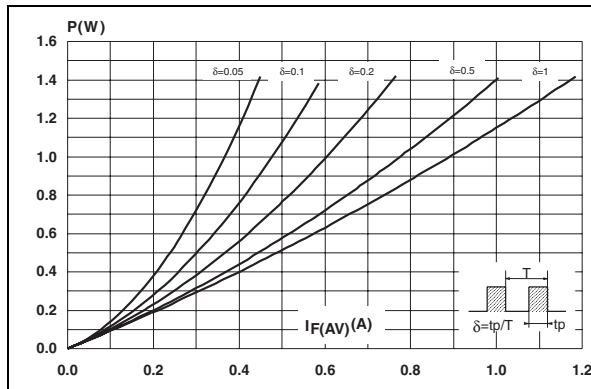


Figure 2. Forward voltage drop versus forward current

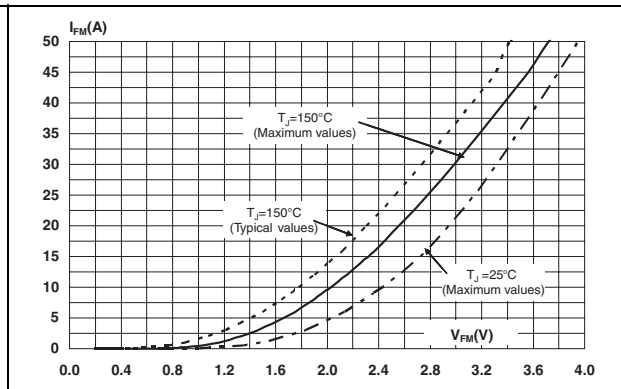


Figure 3. Relative variation of thermal impedance junction to lead versus pulse duration (DO-41)

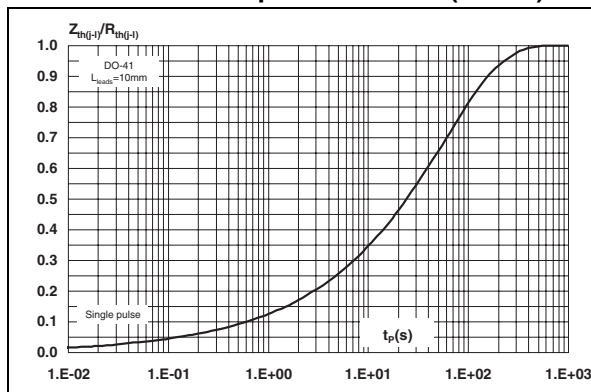


Figure 4. Relative variation of thermal impedance junction to lead versus pulse duration (DO-15)

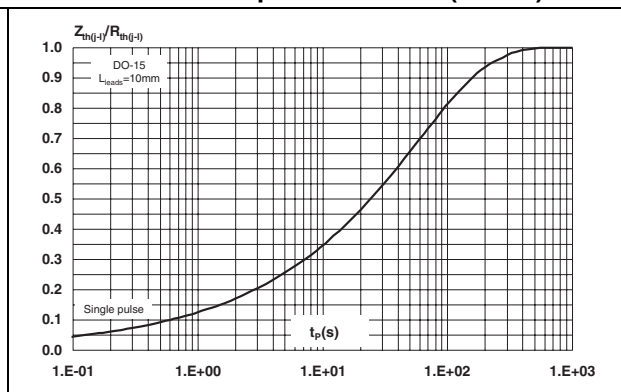


Figure 5. Relative variation of thermal impedance junction to lead versus pulse duration, SMA

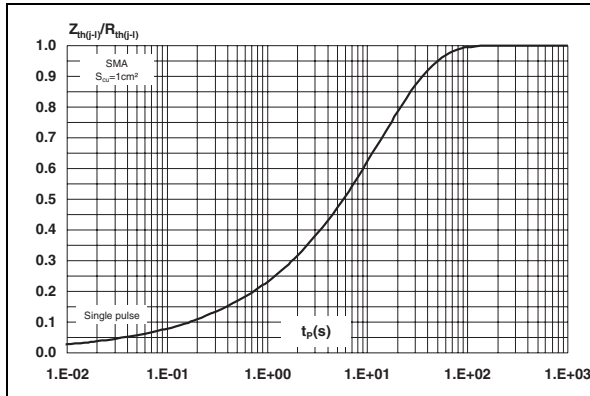


Figure 6. Relative variation of thermal impedance junction to lead versus pulse duration, SMB

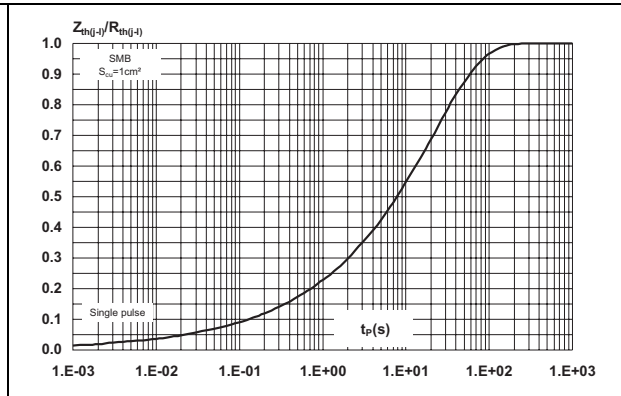


Figure 7. Junction capacitance versus reverse voltage applied (typical values)

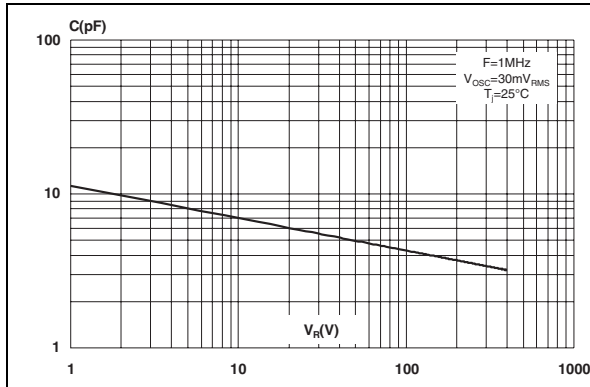


Figure 8. Reverse recovery charges versus di_F/dt (typical values)

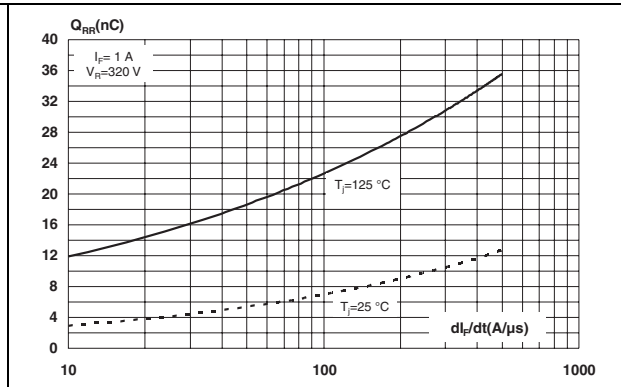


Figure 9. Reverse recovery time versus di_F/dt (typical values)

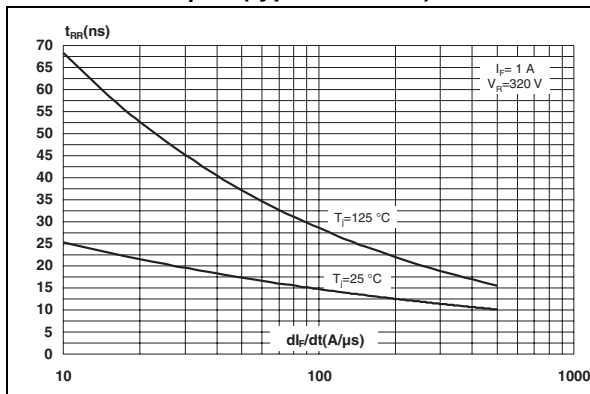


Figure 10. Peak reverse recovery current versus di_F/dt (typical values)

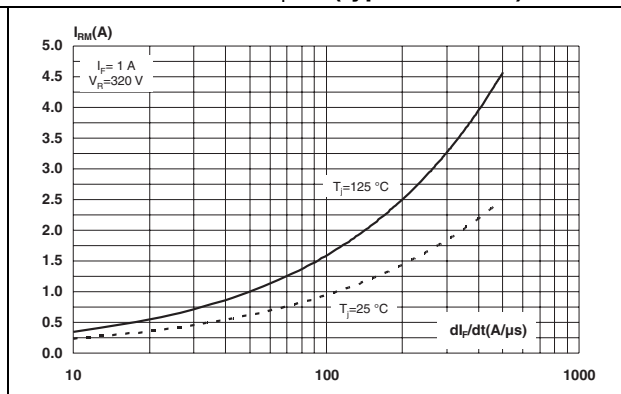


Figure 11. Relative variations of dynamic parameters versus junction temperature

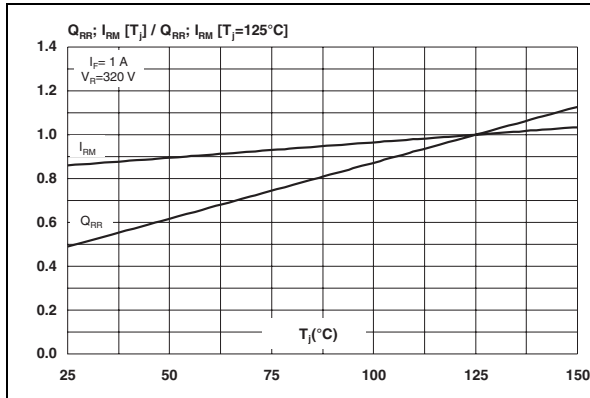


Figure 12. Transient peak forward voltage versus di_F/dt (typical values)

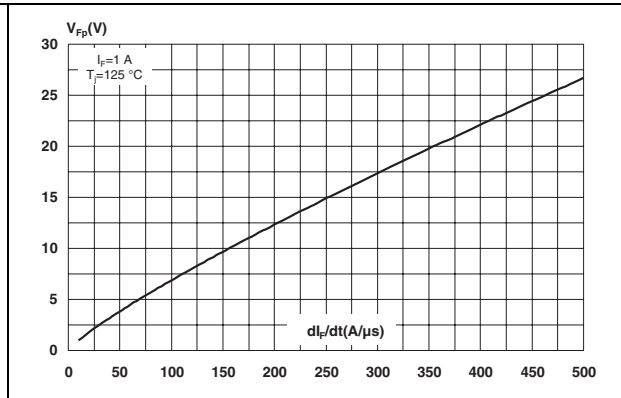


Figure 13. Forward recovery time versus di_F/dt (typical values)

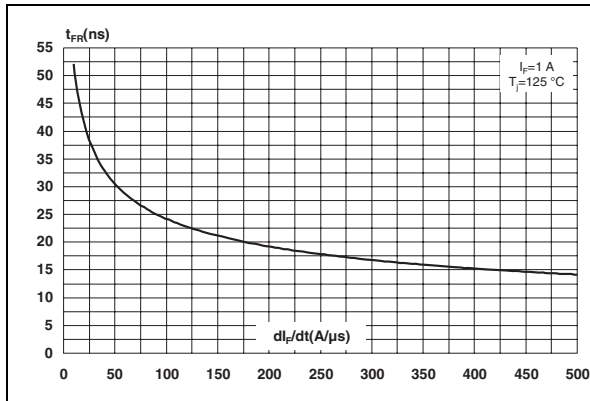


Figure 14. Thermal resistance versus lead length (DO-41)

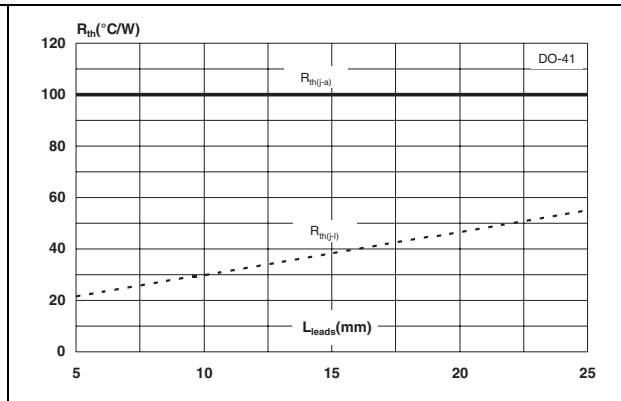


Figure 15. Thermal resistance junction to ambient versus lead length, DO-15

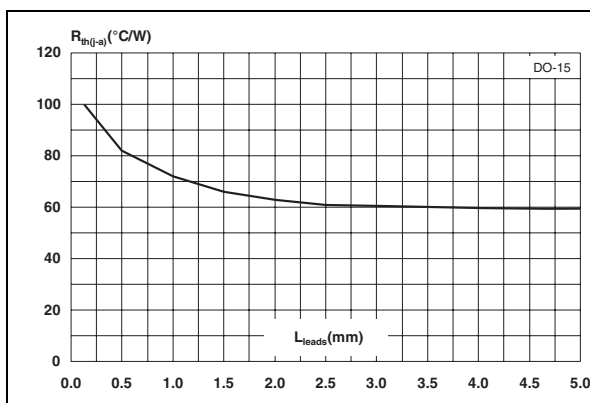
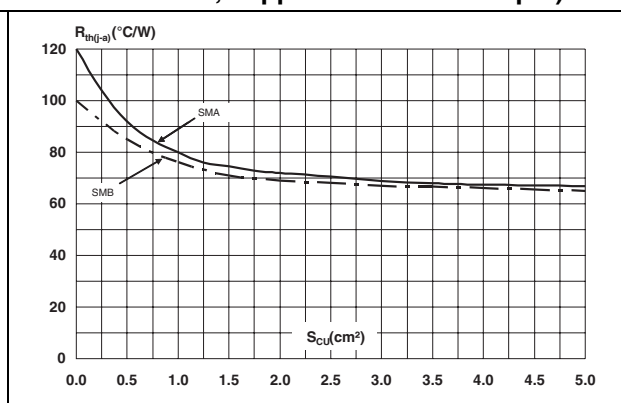


Figure 16. Thermal resistance junction to ambient versus copper surface under each lead, SMA, SMB, (epoxy FR4, copper thickness = 35 μm)



2 Package information

- Epoxy meets UL94, V0
- Cooling method: by conduction (C)

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 6. DO-41 (plastic) dimensions

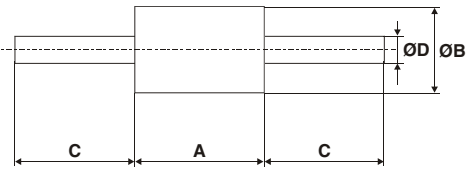
	Dimensions				
	Ref.	Millimeters		Inches	
		Min.	Max.	Min.	Max.
	A	4.1	5.20	0.160	0.205
B	2	2.71	0.080	0.107	
C	25.4		1		
D	0.712	0.863	0.028	0.034	

Table 7. DO-15 dimensions

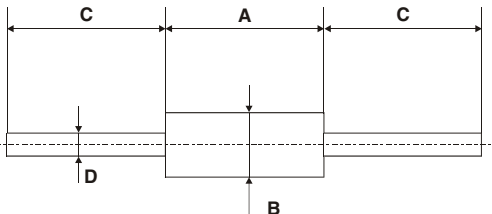
	Dimensions				
	Ref.	Millimeters		Inches	
		Min.	Max.	Min.	Max.
	A	6.05	6.75	0.238	0.266
B	2.95	3.53	0.116	0.139	
C	26	31	1.024	1.220	
D	0.71	0.88	0.028	0.035	

Table 8. SMA dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.094
A2	0.05	0.20	0.002	0.008
b	1.25	1.65	0.049	0.065
c	0.15	0.40	0.006	0.016
D	2.25	2.90	0.089	0.114
E	4.80	5.35	0.189	0.211
E1	3.95	4.60	0.156	0.181
L	0.75	1.50	0.030	0.059

Figure 17. Footprint, dimensions in mm (inches)

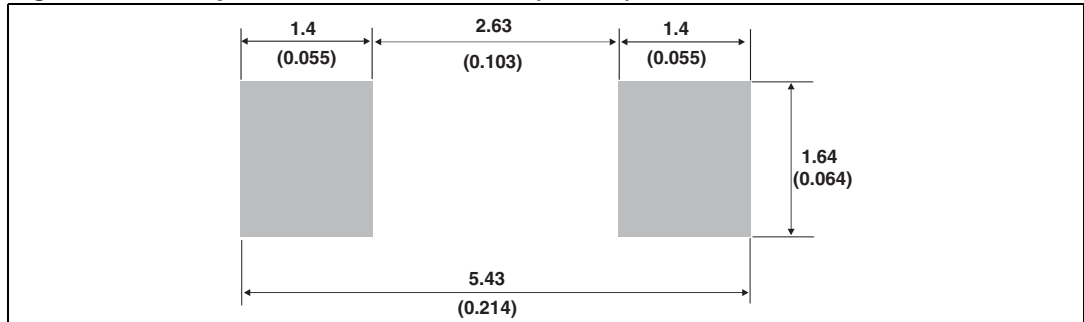
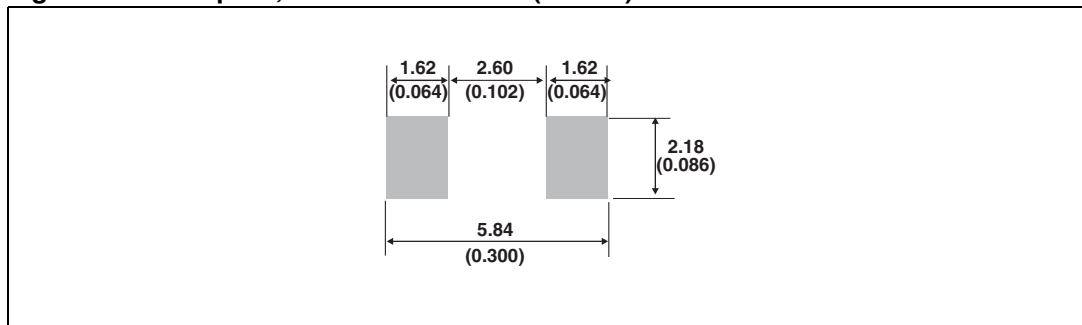


Table 9. SMB dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.40	0.006	0.016
D	3.30	3.95	0.130	0.156
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
L	0.75	1.50	0.030	0.059

Figure 18. Footprint, dimensions in mm (inches)



3 Ordering information

Table 10. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH1R04	STTH1R04	DO-41	0.34 g	1000	Ammopack
STTH1R04RL	STTH1R04	DO-41	0.34 g	5000	Tape and reel
STTH1R04Q	STTH1R04Q	DO-15	0.4 g	1000	Ammopack
STTH1R04QRL	STTH1R04Q	DO-15	0.4 g	6000	Tape and reel
STTH1R04A	HR4	SMA	0.068 g	5000	Tape and reel
STTH1R04U	BR4	SMB	0.12 g	2500	Tape and reel

4 Revision history

Table 11. Document revision history

Date	Revision	Description of changes
30-May-2008	1	First issue

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.

© 2008 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