



STN3PF06

P-channel 60 V - 0.20 Ω - 2.5 A - SOT-223
STripFET™ II Power MOSFET

Features

| Type | V _{DSS} | R _{DS(on) max} | I _D |
|----------|------------------|-------------------------|----------------|
| STN3PF06 | 60 V | < 0.22 Ω | 2.5 A |

- Extremely dv/dt capability
- 100% avalanche tested
- Application oriented characterization

Application

- Switching applications

Description

This Power MOSFET is the latest development of STMicroelectronics unique “single feature size” strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

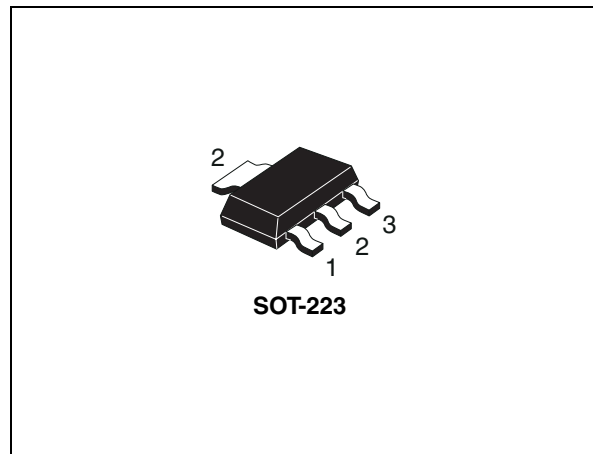


Figure 1. Internal schematic diagram

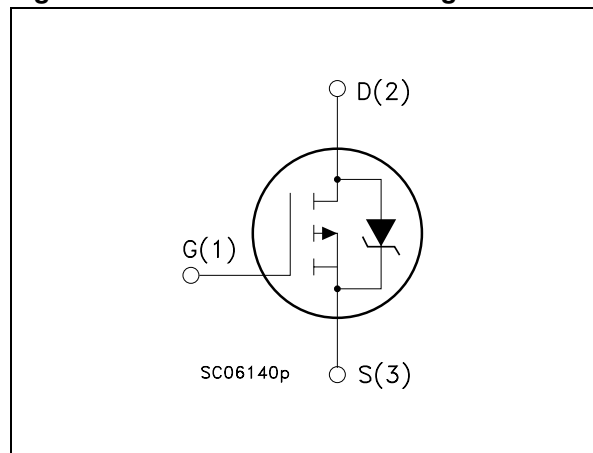


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|---------|---------------|
| STN3PF06 | N3PF06 | SOT-223 | Tape and reel |

Contents

| | | |
|----------|---|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| | 2.1 Electrical characteristics (curves) | 6 |
| 3 | Test circuits | 8 |
| 4 | Package mechanical data | 9 |
| 5 | Revision history | 11 |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------|---|------------|---------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 60 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 2.5 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 1.5 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 10 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 2.5 | W |
| | Derating factor | 0.02 | W/ $^\circ\text{C}$ |
| $dv/dt^{(2)}$ | Peak diode recovery voltage slope | 6 | V/ns |
| T_j T_{stg} | Operating junction temperature Storage temperature | -65 to 150 | $^\circ\text{C}$ |

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 3\text{A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------|--|-------|---------------------------|
| $R_{thj-pcb}$ | Thermal resistance junction-pcb board max | 50 | $^\circ\text{C}/\text{W}$ |
| R_{thj-a} | Thermal resistance junction-ambient max ⁽¹⁾ | 62.5 | $^\circ\text{C}/\text{W}$ |
| T_l | Maximum lead temperature for soldering purpose | 260 | $^\circ\text{C}$ |

1. Surface mounted

Note: For the p-channel Power MOSFET actual polarity of voltages and current has to be reversed

2 Electrical characteristics

($T_{CASE}=25\text{ °C}$ unless otherwise specified)

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250\ \mu\text{A}$, $V_{GS} = 0$ | 60 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C=125\text{ °C}$ | | | 1 10 | μA μA |
| $I_{D(on)}$ | On state drain current | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$, $V_{GS} = 10\text{ V}$ | 2.5 | | | A |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$ | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10\text{ V}$, $I_D = 1.5\text{ A}$ | | 0.20 | 0.22 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|------|
| g_{fs} | Forward transconductance | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$, $I_D = 1.25\text{ A}$ | | 1.5 | | S |
| C_{iss} | Input capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | | 850 | | pF |
| C_{oss} | Output capacitance | | | 230 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 75 | | pF |
| Q_g | Total gate charge | $I_D = 12\text{ A}$, $V_{DD} = 48\text{ V}$, $V_{GS} = 10\text{ V}$ <i>(see Figure 14)</i> | | 16 | 21 | nC |
| Q_{gs} | Gate-source charge | | | 4 | | nC |
| Q_{gd} | Gate-drain charge | | | 6 | | nC |

Note: For the p-channel Power MOSFET actual polarity of voltages and current has to be reversed

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|---|--|------|----------------|------|----------------|
| $t_{d(on)}$ t_r | Turn-on delay time Rise time | $V_{DD}=30\text{ V}$, $I_D=6\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 13) | | 20 40 | | ns ns |
| $t_{d(off)}$ t_f | Turn-off delay time Fall time | $V_{DD}=30\text{ V}$, $I_D=6\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 13) | | 40 10 | | ns ns |
| $t_{r(Voff)}$ t_f t_c | Off-voltage rise time Fall time Cross-over time | $V_{clamp}=48\text{ V}$, $I_D=12\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (see Figure 13) | | 10 17 30 | | ns ns ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|-----------------|-------------------------------|---|-----|------|-----|---------------|
| I_{SD} | Source-drain current | | | | 2.5 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 10 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD}=1.5\text{ A}$, $V_{GS}=0$ | | | 1.2 | V |
| t_{rr} | Reverse recovery time | $I_{SD}=12\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$ $V_{DD}=30\text{ V}$, $T_j=150\text{ }^\circ\text{C}$ | | 100 | | ns |
| Q_{rr} | Reverse recovery charge | | | 260 | | μC |
| I_{RRM} | Reverse recovery current | | | 5.2 | | A |

1. Pulse width limited by T_{jmax}

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Note: For the p-channel Power MOSFET actual polarity of voltages and current has to be reversed

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

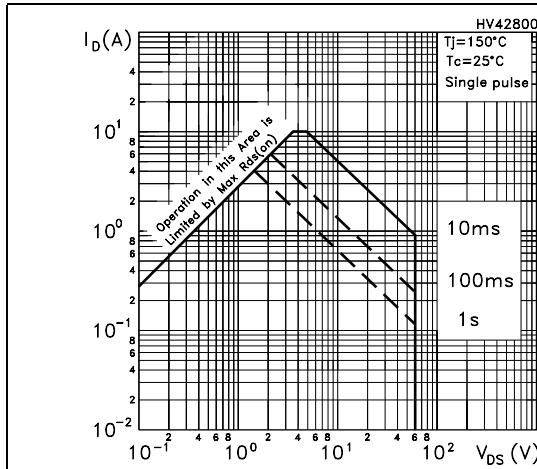


Figure 3. Thermal impedance

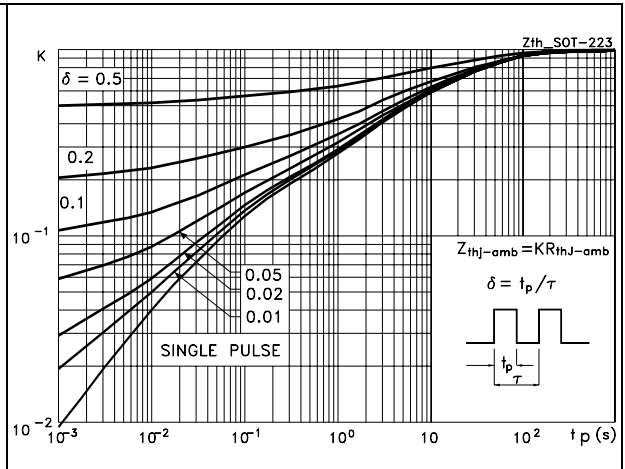


Figure 4. Output characteristics

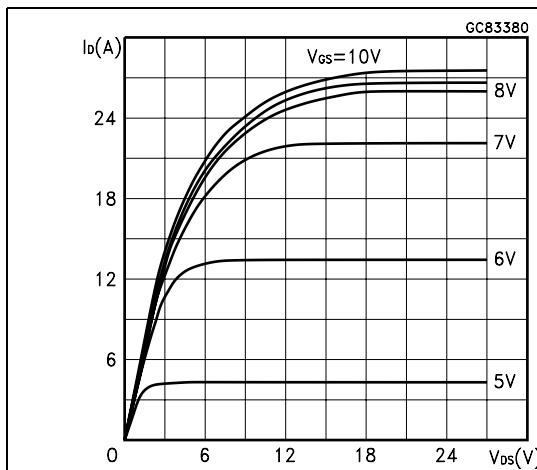


Figure 5. Transfer characteristics

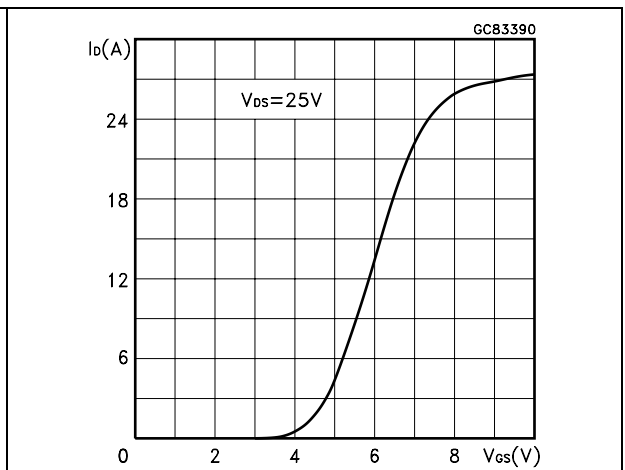


Figure 6. Transconductance

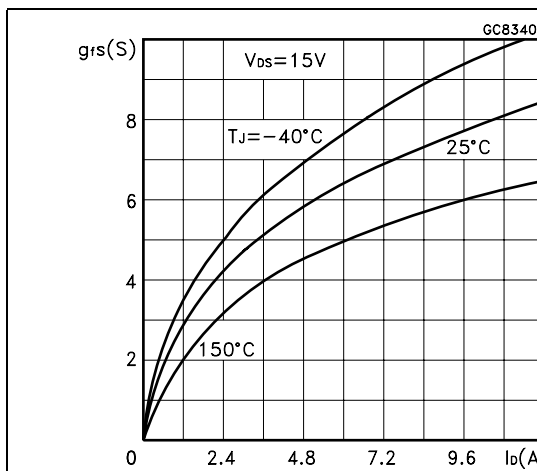


Figure 7. Static drain-source on resistance

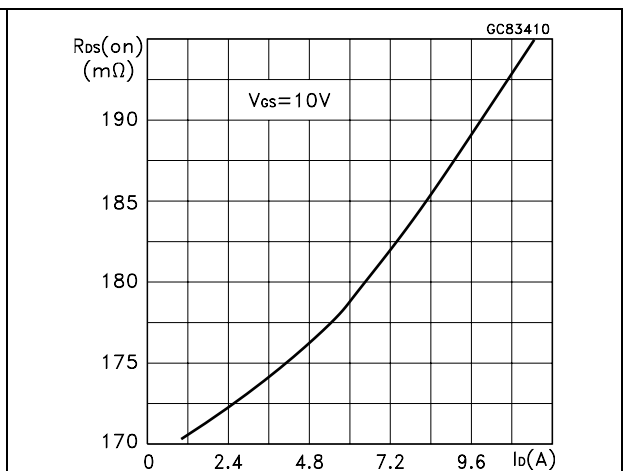


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

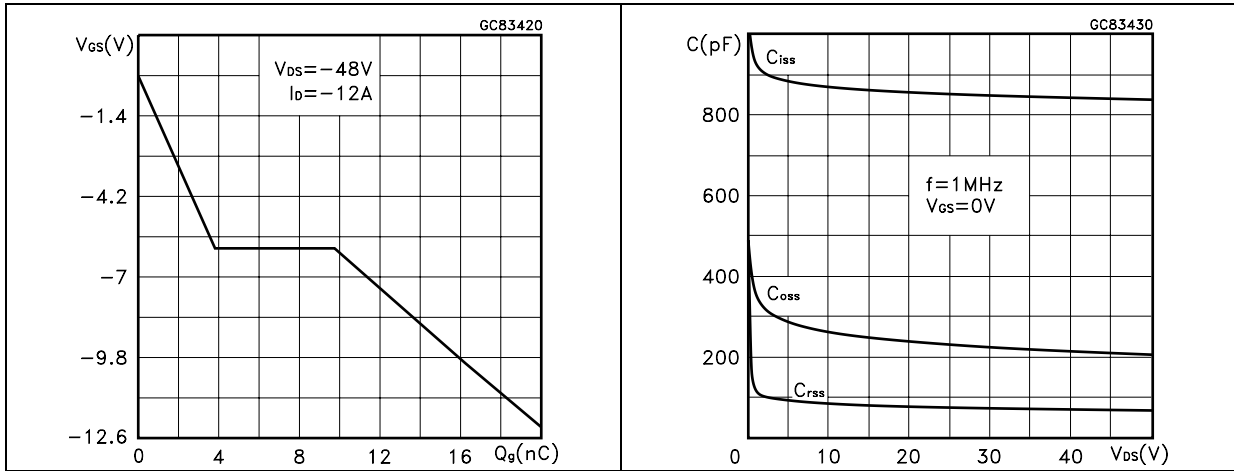


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

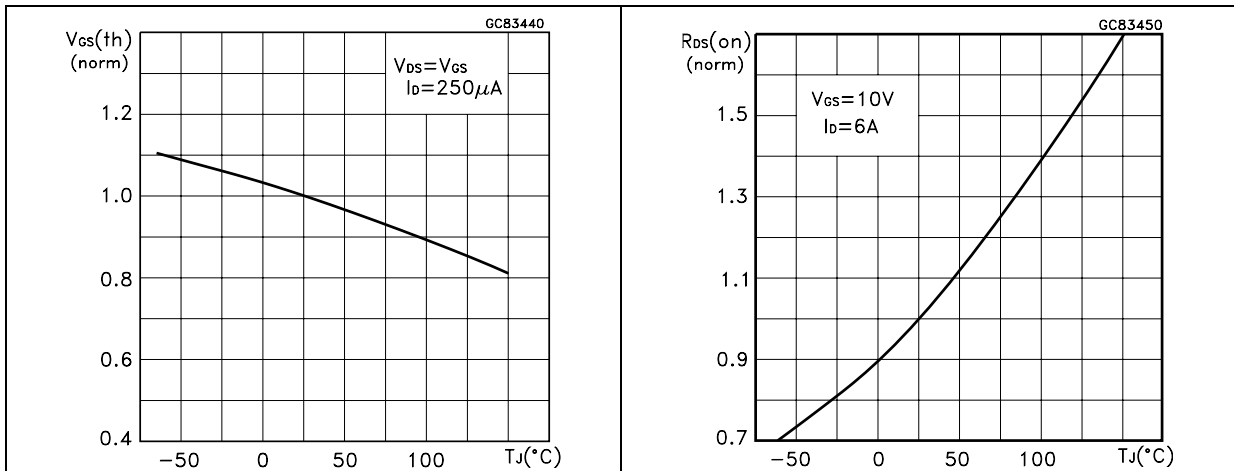
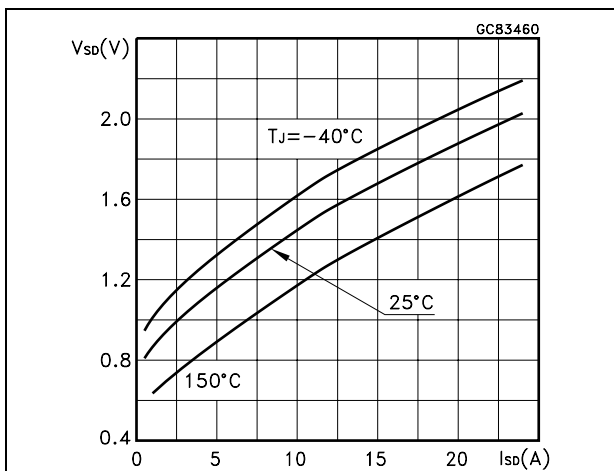


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

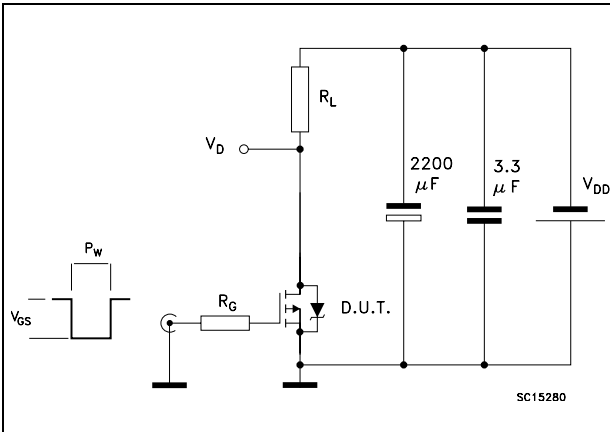


Figure 14. Gate charge test circuit

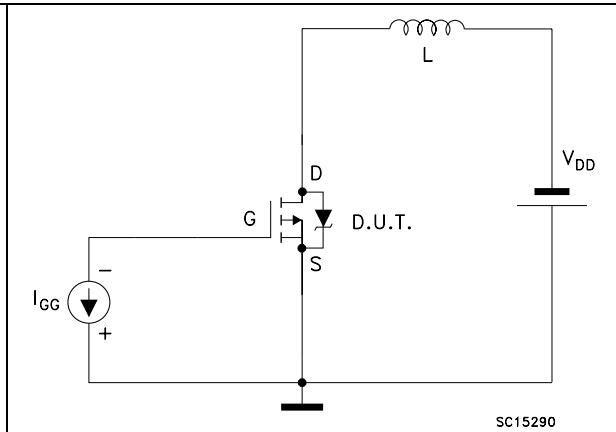
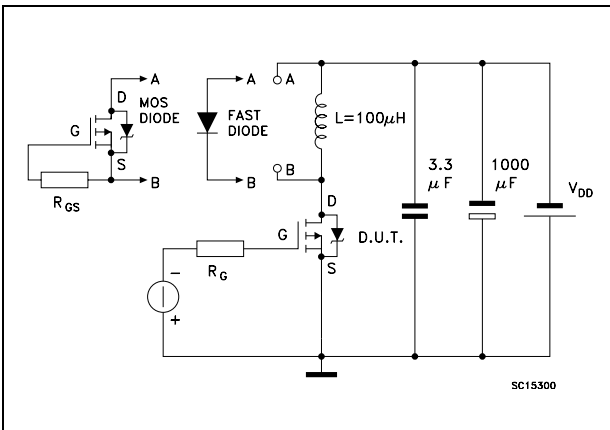


Figure 15. Test circuit for inductive load switching and diode recovery times



4 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

| SOT-223 MECHANICAL DATA | | | | | | |
|-------------------------|------|------|------|-------|-------|-------|
| DIM. | mm | | | inch | | |
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.80 | | | 0.071 |
| B | 0.60 | 0.70 | 0.80 | 0.024 | 0.027 | 0.031 |
| B1 | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| c | 0.24 | 0.26 | 0.32 | 0.009 | 0.010 | 0.013 |
| D | 6.30 | 6.50 | 6.70 | 0.248 | 0.256 | 0.264 |
| e | | 2.30 | | | 0.090 | |
| e1 | | 4.60 | | | 0.181 | |
| E | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.146 |
| H | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| V | | | 10° | | | 10° |
| A1 | | 0.02 | | | | |

P008B

5 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|-----------------|--|
| 08-May-2007 | 3 | The document has been reformatted |
| 27-Mar-2008 | 4 | Document status promoted from preliminary data to datasheet. |

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