

High voltage fast-switching NPN power transistor

Datasheet – production data

Features

- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

Applications

- Electronic ballast for fluorescent lighting
- Switch mode power supplies

Description

This device is manufactured using high voltage multi epitaxial planar technology for high switching speeds and high voltage capability. It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining a wide RBSOA.

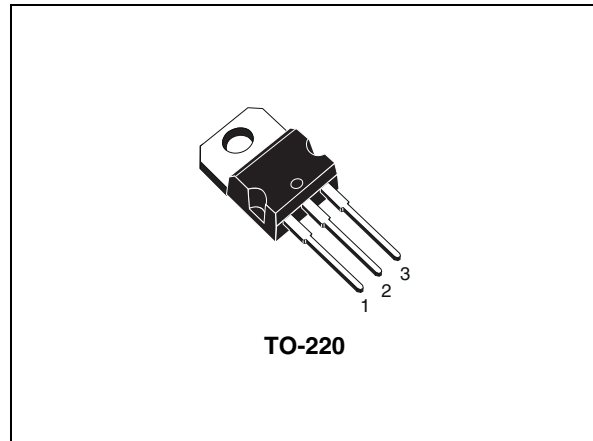


Figure 1. Internal schematic diagram

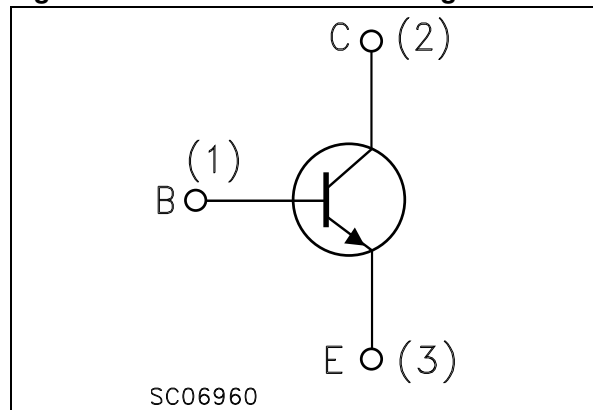


Table 1. Device summary

| Order code | Marking ⁽¹⁾ | Package | Packaging |
|------------|-----------------------------------------------------|---------|-----------|
| ST13005 | 13005 A 13005 C 13005 D 13005 E 13005 F | TO-220 | Tube |

1. Product is pre-selected in DC current gain (group A, C, D, E and F). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

Contents

| | | |
|----------|-------------------------------------------|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| 2.1 | Electrical characteristics (curves) | 5 |
| 2.2 | Test circuits | 7 |
| 3 | Package mechanical data | 8 |
| 4 | Revision history | 11 |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|--------------------------------------------|-------------|------|
| V_{CES} | Collector-emitter voltage ($V_{BE} = 0$) | 700 | V |
| V_{CEO} | Collector-emitter voltage ($I_B = 0$) | 400 | V |
| V_{EBO} | Emitter-base voltage ($I_C = 0$) | 9 | V |
| I_C | Collector current | 4 | A |
| I_{CM} | Collector peak current ($t_P < 5$ ms) | 8 | A |
| I_B | Base current | 2 | A |
| I_{BM} | Base peak current ($t_P < 5$ ms) | 4 | A |
| P_{TOT} | Total dissipation at $T_c \leq 25$ °C | 75 | W |
| T_{STG} | Storage temperature | - 65 to 150 | °C |
| T_J | Max. operating junction temperature | 150 | °C |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|----------------|--------------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case max | 1.7 | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-amb max | 62.5 | °C/W |

2 Electrical characteristics

$T_{case} = 25\text{ °C}$ unless otherwise specified.

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------|-------------------------------------------------------|---------------------------------------------------------------------------------|------|------|------|---------------|
| I_{CES} | Collector cut-off current ($V_{BE} = 0$) | $V_{CE} = 700\text{ V}$ | | | 1 | mA |
| | | $V_{CE} = 700\text{ V } T_C = 125\text{ °C}$ | | | 5 | mA |
| I_{EBO} | Emitter cut-off current ($I_C = 0$) | $V_{EB} = 9\text{ V}$ | | | 1 | mA |
| $V_{CEO(sus)}^{(1)}$ | Collector-emitter sustaining voltage ($I_B = 0$) | $I_C = 10\text{ mA}$ | 400 | | | V |
| $V_{CE(sat)}^{(1)}$ | Collector-emitter saturation voltage | $I_C = 1\text{ A } I_B = 0.2\text{ A}$ | | | 0.5 | V |
| | | $I_C = 2\text{ A } I_B = 0.5\text{ A}$ | | | 0.6 | V |
| | | $I_C = 4\text{ A } I_B = 1\text{ A}$ | | | 1 | V |
| $V_{BE(sat)}^{(1)}$ | Base-emitter saturation voltage | $I_C = 1\text{ A } I_B = 0.2\text{ A}$ | | | 1.2 | V |
| | | $I_C = 2\text{ A } I_B = 0.5\text{ A}$ | | | 1.6 | V |
| $h_{FE}^{(1)(2)}$ | DC current gain | $I_C = 1\text{ A } V_{CE} = 5\text{ V}$ | | | | |
| | | Group A | 15 | | 32 | |
| | | Group C | 16 | | 22 | |
| | | Group D | 21 | | 27 | |
| | | Group E | 26 | | 32 | |
| | | Group F | 31 | | 37 | |
| | | $I_C = 2\text{ A } V_{CE} = 5\text{ V}$ | 8 | | 40 | |
| t_s | Resistive load Storage time | $I_C = 2\text{ A } V_{CC} = 125\text{ A}$ $I_{B1} = - I_{B2} = 0.4\text{ A}$ | 1.5 | | 3 | μs |
| t_f | Fall time | $t_p = 30\text{ }\mu\text{s}$ | | 0.2 | | μs |

1. Pulse test: pulse duration = 300 μs , duty cycle $\leq 2\%$.
2. Product is pre-selected in DC current gain (group A, C, D, E and F). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

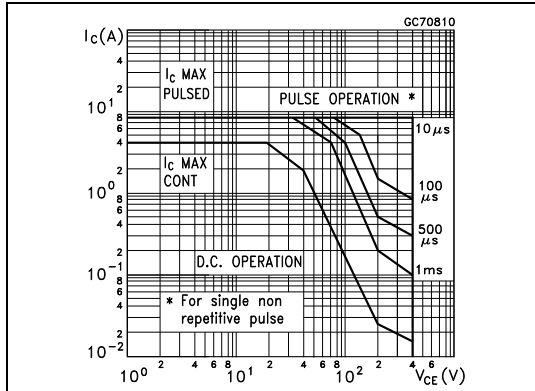


Figure 3. Derating curve

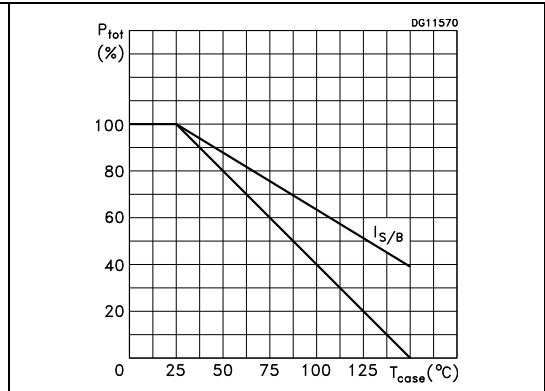


Figure 4. DC current gain ($V_{CE} = 1.5 V$)

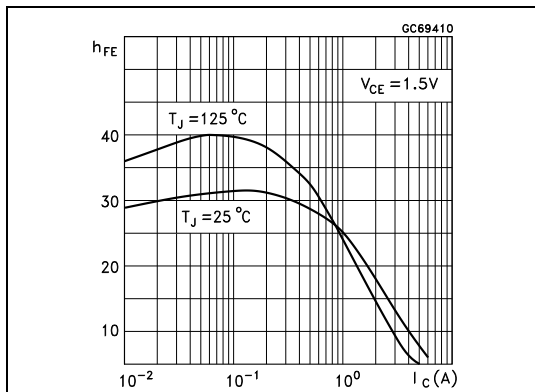


Figure 5. DC current gain ($V_{CE} = 5 V$)

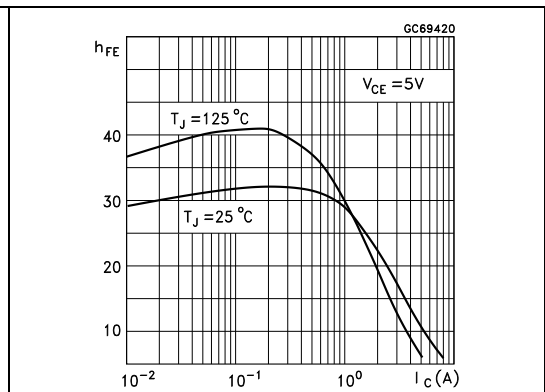


Figure 6. Collector-emitter saturation voltage

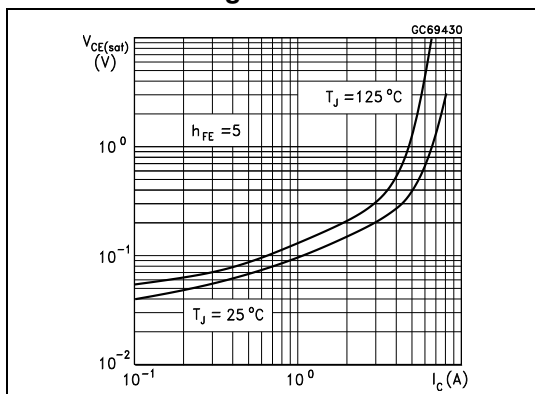


Figure 7. Base-emitter saturation voltage

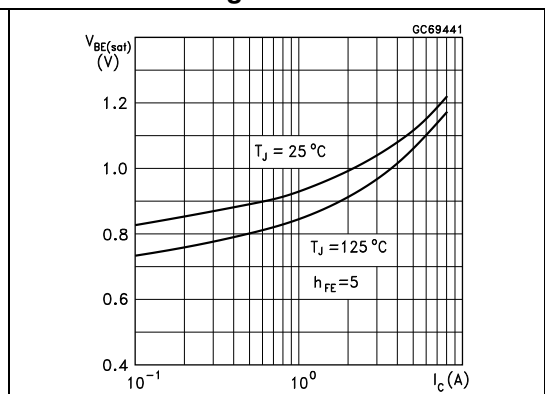


Figure 8. Inductive load fall time

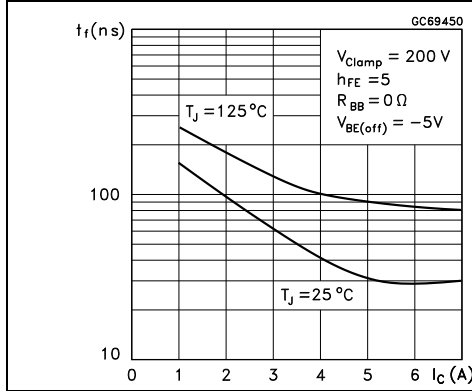


Figure 9. Inductive load storage time

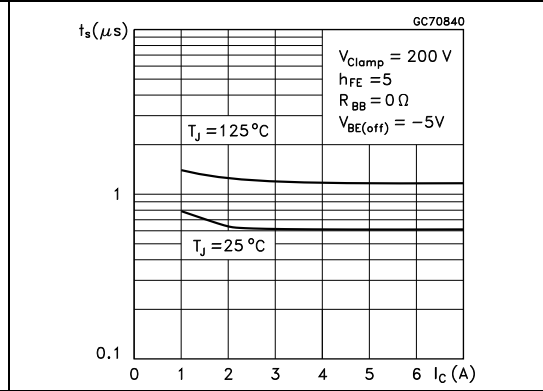


Figure 10. Resistive load fall time

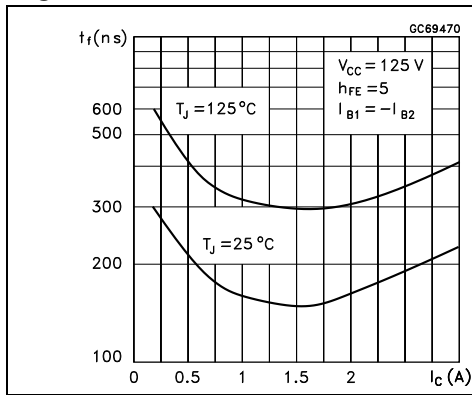


Figure 11. Resistive load storage time

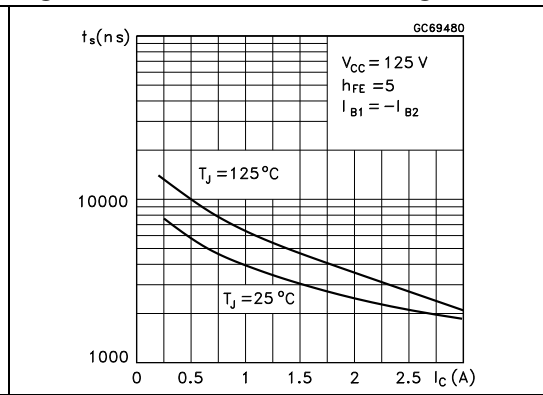
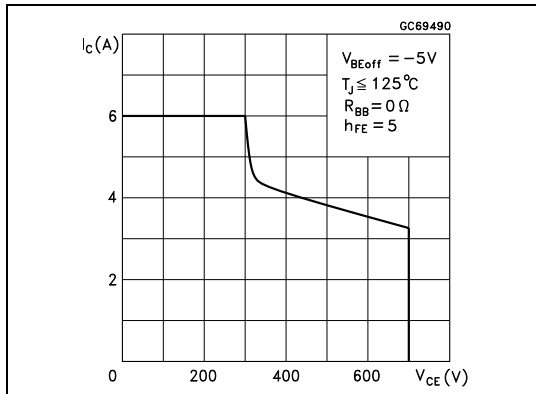


Figure 12. Reverse biased safe operating area



2.2 Test circuits

Figure 13. Inductive load switching test circuit

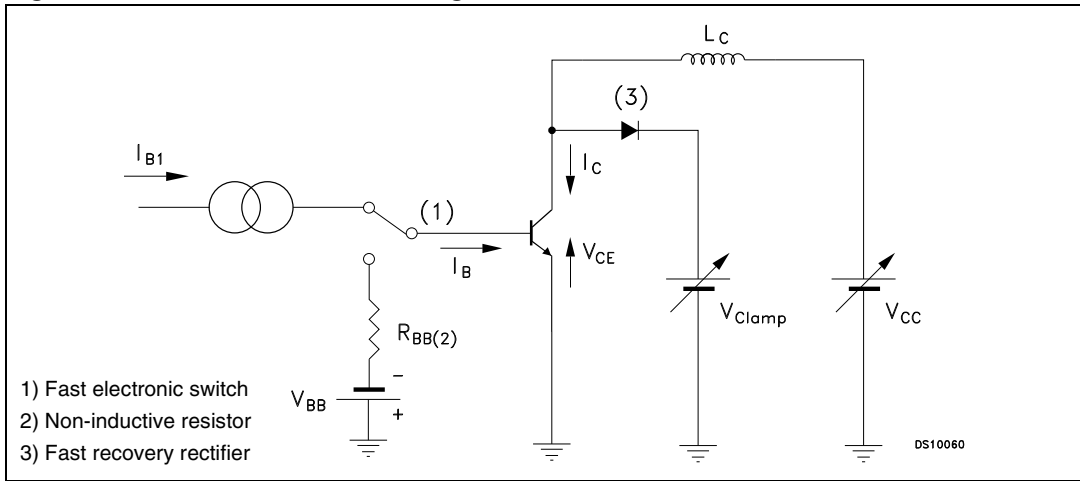
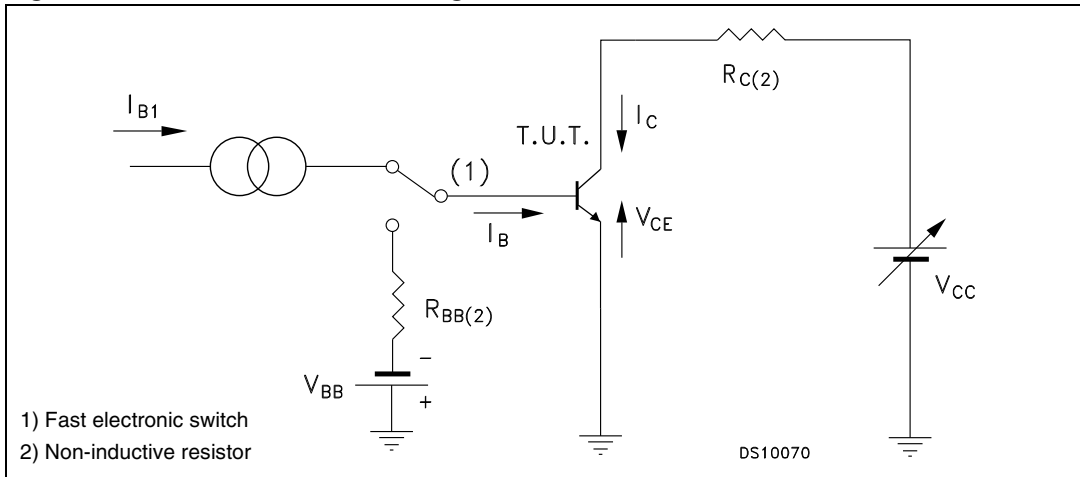


Figure 14. Resistive load switching test circuit



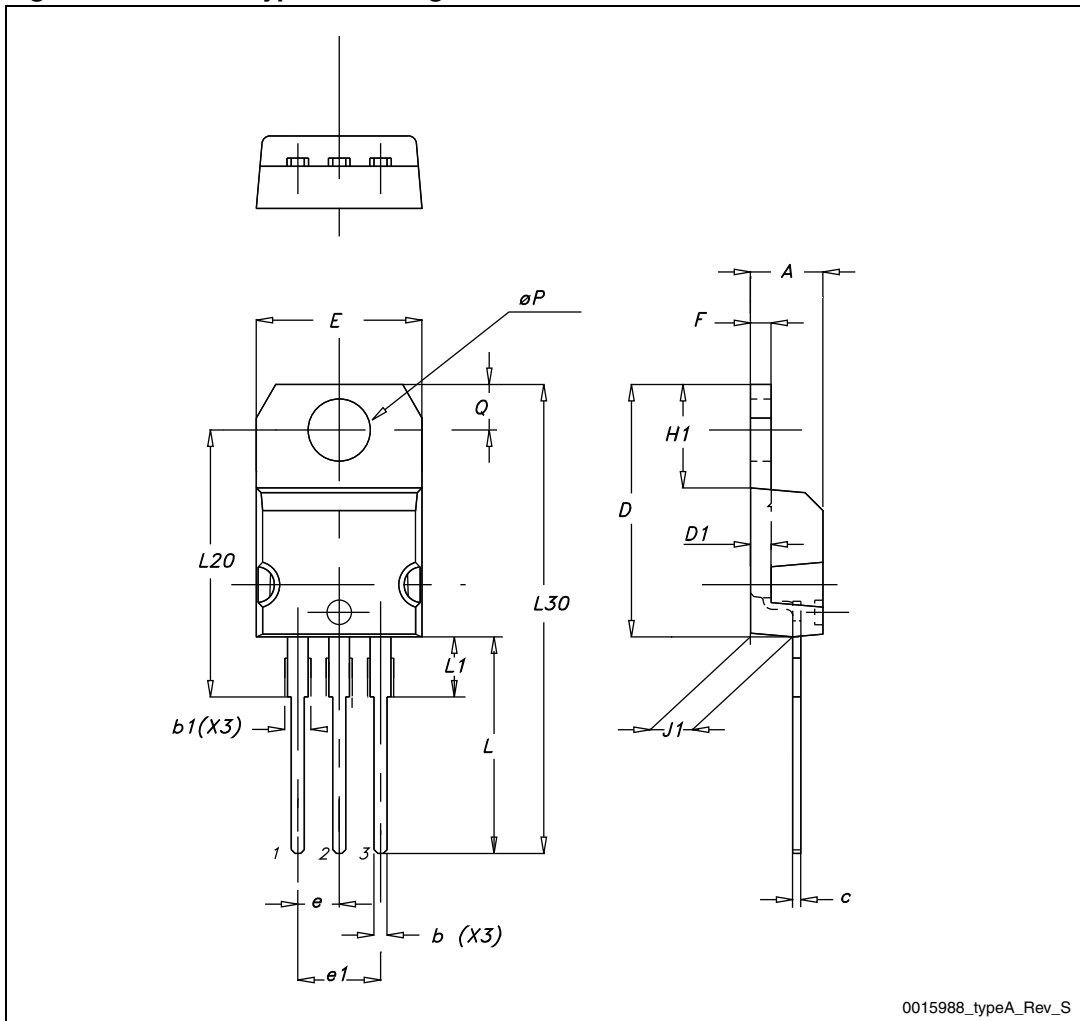
3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

Table 5. TO-220 type A mechanical data

| Dim. | mm. | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

Figure 15. TO-220 type A drawing



4 Revision history

Table 6. Document revision history

| Date | Revision | Changes |
|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21-Jun-2004 | 6 | |
| 22-Aug-2007 | 7 | Updated mechanical data according to PCN APM-PWR/07/2804 |
| 12-Oct-2007 | 8 | Updated marking in Table 1 |
| 15-Feb-2012 | 9 | <ul style="list-style-type: none">– Updated marking in Table 1– Inserted: Table 3– Modified: h_{FE} in Table 4– Updated mechanical data |
| 15-May-2012 | 10 | Updated marking in Table 1 and 4 |

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 TWO AUTHORIZED ST REPRESENTATIVES, 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.

© 2012 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 - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com