STGW50HF60S

60 A, 600 V, very low drop IGBT

Features

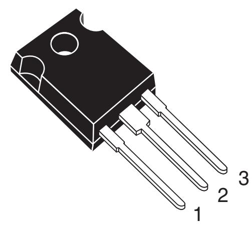
- Very low on-state voltage drop
- Low switching off
- High current capability

Applications

- PV inverter
- UPS

Description

STGW50HF60S is a very low drop IGBT based on new advanced planar technology, showing extremely low on-state voltage and limited turn-off losses. The overall performance makes this IGBT ideal in low frequency switches of mixed frequency topologies for PF ≤ 1.



TO-247

Figure 1. Internal schematic diagram

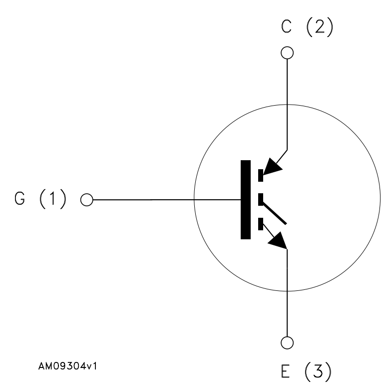


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW50HF60S	GW50HF60S	TO-247	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	V
I_C (1)	Continuous collector current at T_C = 25 °C	110	A
I_C (1)	Continuous collector current at T_C = 100 °C	60	A
I_{CL} (2)	Turn-off latching current	60	A
I_{CP} (3)	Pulsed collector current	130	A
V_{GE}	Gate-emitter voltage	±20	V
P_{TOT}	Total dissipation at T_C = 25 °C	284	W
T_j	Operating junction temperature	- 55 to 150	°C

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. Vclamp = 80% of V_{CES}, T_j =150 °C, R_G=10 Ω, V_{GE}=15 V
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case	0.44	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

T_J = 25 °C unless otherwise specified.

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE} = 0)	I_C = 1 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 30 A V_{GE}= 15 V, I_C= 30 A, T_J =125 °C		1.15 1.05	1.45	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.5		5.7	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} =600 V V_{CE} =600 V, T_J=125 °C			50 500	µA µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} =± 20 V			± 100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V, I_C= 30 A		25		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}=0	-	4300 400 100	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 480 V, I_C= 30 A,V_{GE}=15 V	-	200 27 90	-	nC nC nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 14)*	-	50 20 1280	-	ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 14)*	-	47 22 1100	-	ns ns A/µs
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 14)*	-	370 220 465	-	ns ns ns
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 14)*	-	700 250 800	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 14)*	-	0.25 4.2 4.45	-	mJ mJ mJ
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 400 V, I_C = 30 A R_G= 10 Ω, V_{GE}= 15 V, T_J = 125 °C *(see Figure 14)*	-	0.45 7.8 8.25	-	mJ mJ mJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit in *Figure 14*. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs and diode are at the same temperature (25 °C and 125 °C).
2. Turn-off losses include also the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

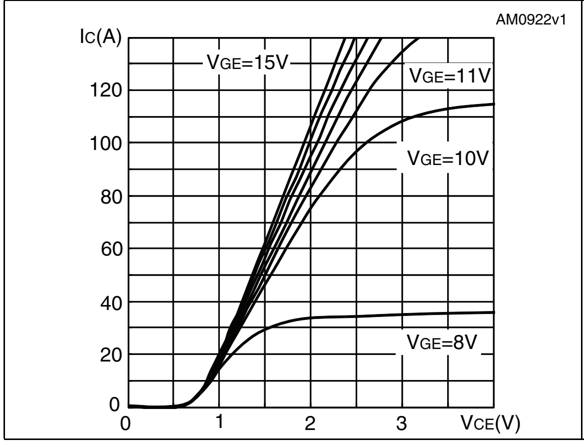


Figure 3. Transfer characteristics

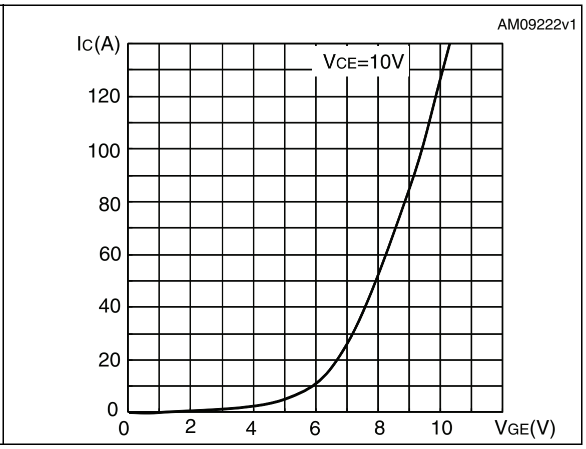


Figure 4. Collector-emitter on voltage vs. temperature

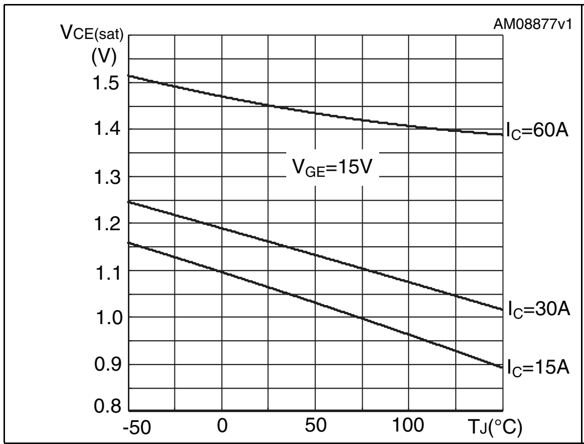


Figure 5. Collector-emitter on voltage vs. collector current

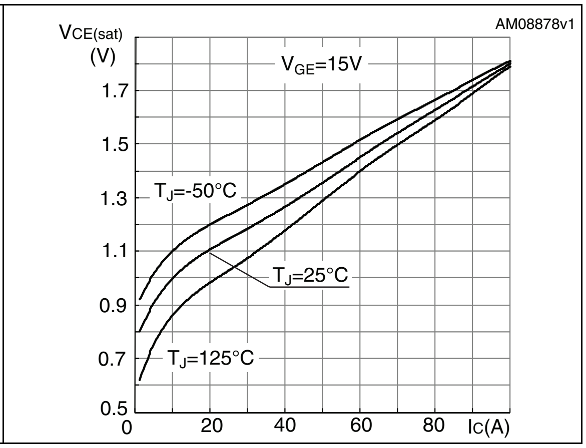


Figure 6. Breakdown voltage vs. temperature

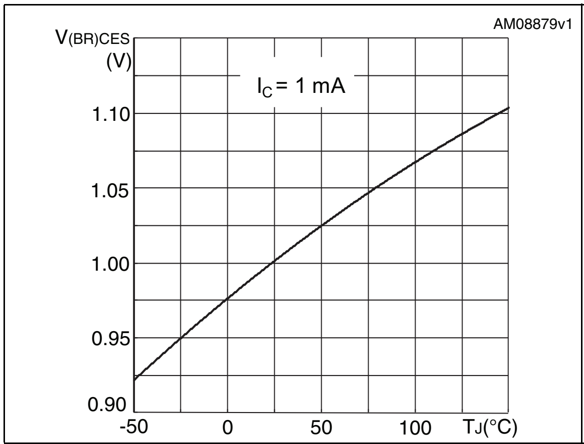


Figure 7. Gate threshold voltage vs. temperature

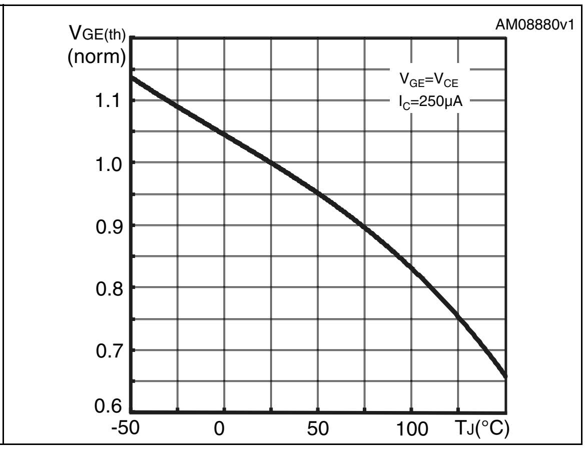


Figure 8. Gate charge vs. gate-emitter voltage

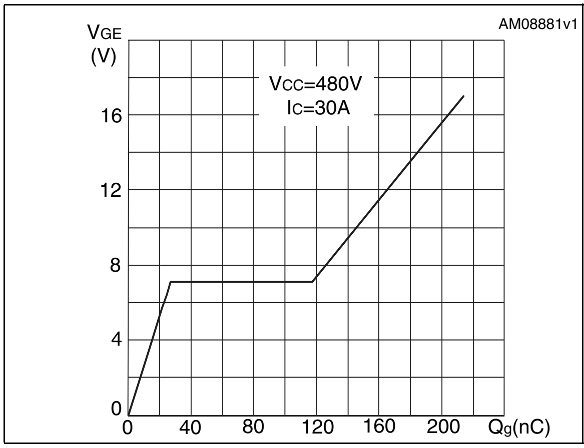


Figure 9. Capacitance variations

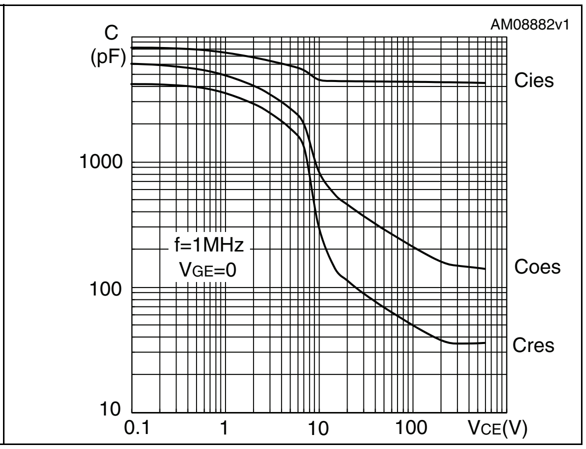


Figure 10. Switching losses vs. collector current

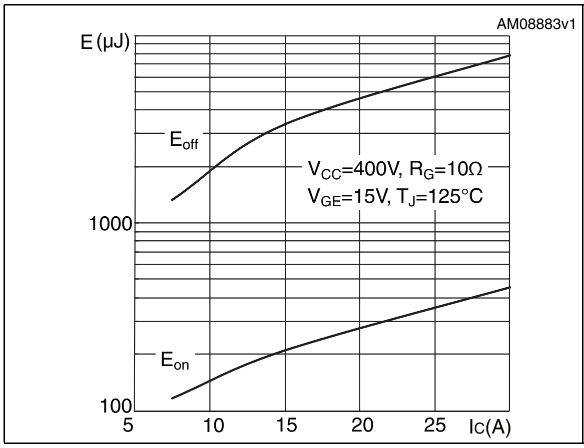


Figure 11. Switching losses vs. gate resistance

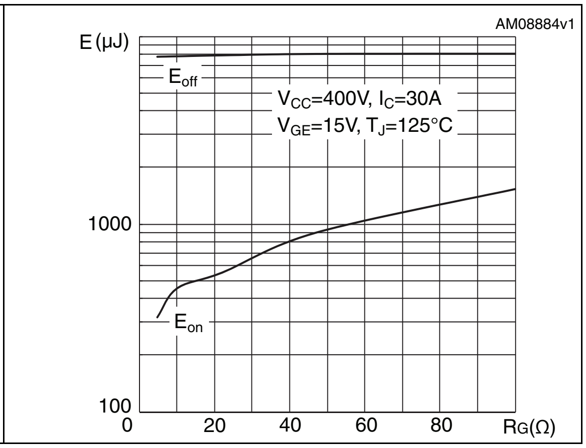


Figure 12. Switching losses vs. temperature

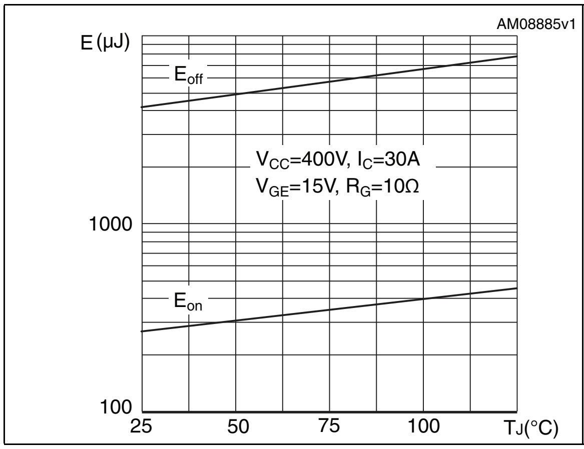
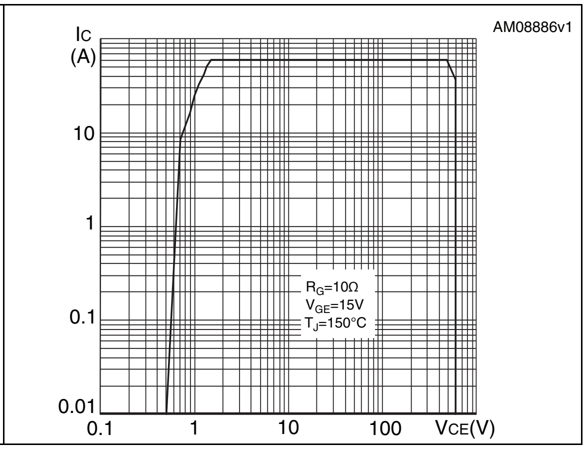


Figure 13. Turn-off SOA



3 Test circuits

Figure 14. Test circuit for inductive load switching

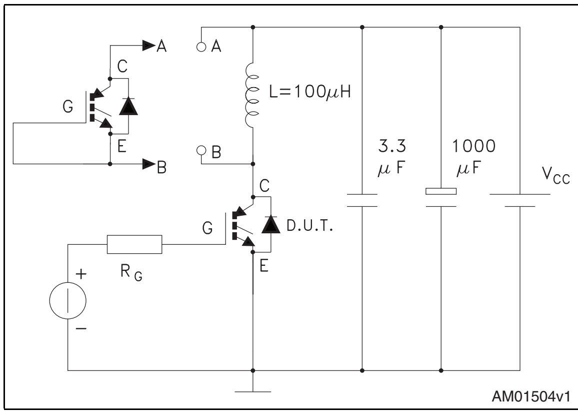


Figure 15. Gate charge test circuit

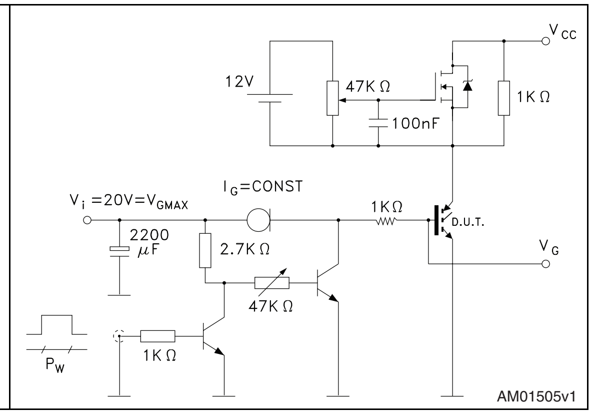
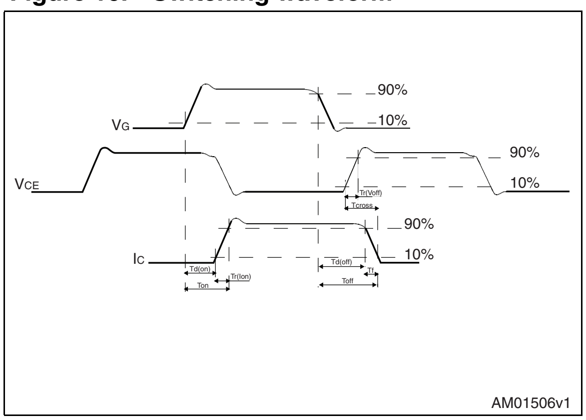


Figure 16. Switching waveform



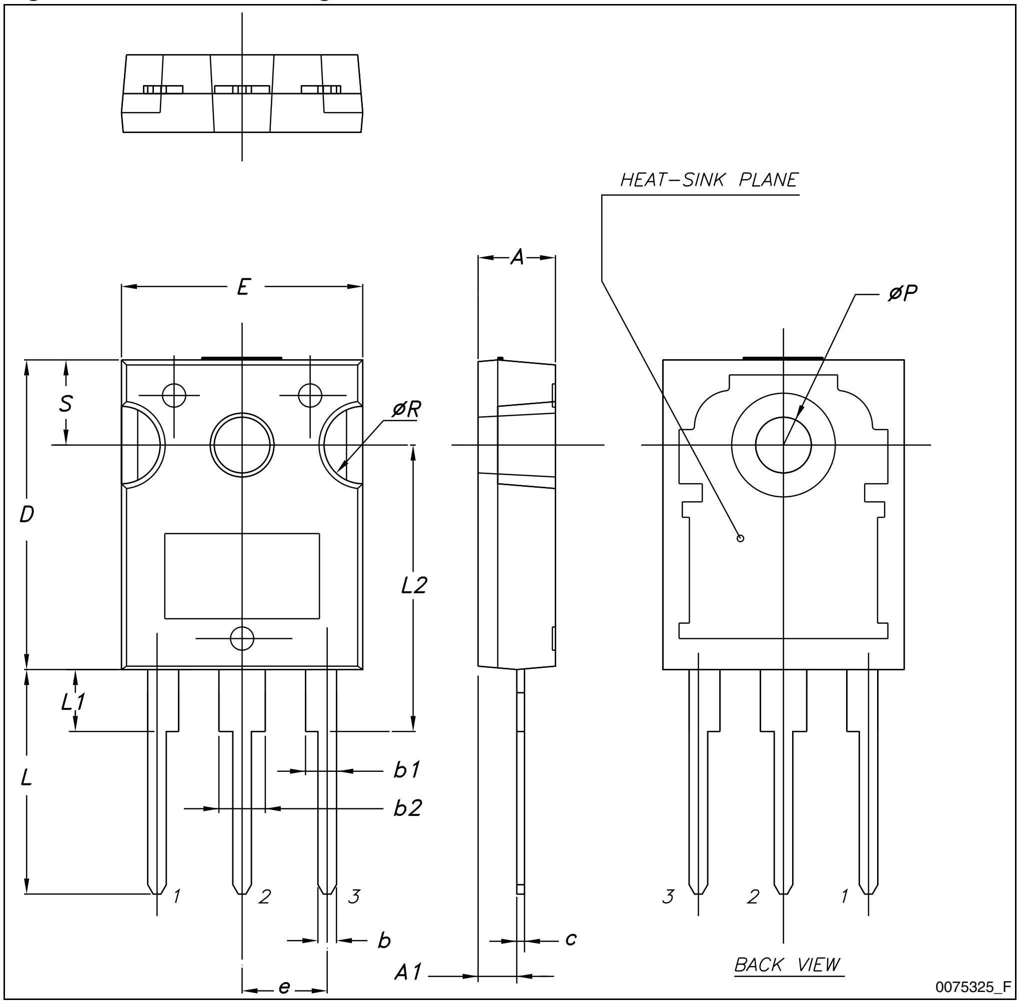
4 Package mechanical data

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 8. TO-247 mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S		5.50	

Figure 17. TO-247 drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
18-Jan-2010	1	Initial release.
21-Jan-2011	2	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.

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