STN3N45K3
STQ3N45K3-AP, STU3N45K3

N-channel 450 V, 3.2 Ω, 1.8 A, TO-92, SOT-223, IPAK SuperMESH3™ Power MOSFET

Preliminary data

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D	Pw
STN3N45K3	450 V	< 3.8 Ω	0.6 A	2 W
STQ3N45K3-AP	450 V	< 3.8 Ω	0.6 A	2.5 W
STU3N45K3	450 V	< 3.8 Ω	1.8 A	27 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

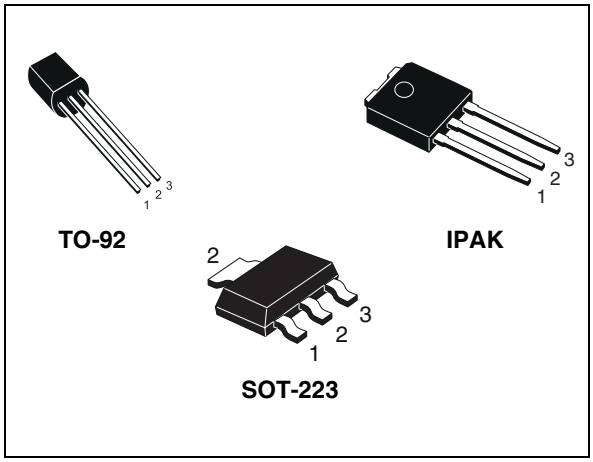
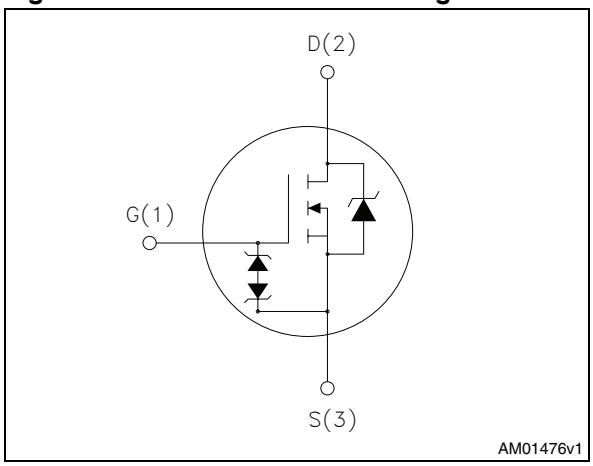


Figure 1. Internal schematic diagram



Application

- Switching applications

Description

The new SuperMESH3™ series is obtained through the combination of a further fine tuning of ST's well established strip-based PowerMESH™ layout with a new optimization of the vertical structure. In addition to reducing on-resistance significantly versus previous generation, special attention has been taken to ensure a very good dv/dt capability and higher margin in breakdown voltage for the most demanding application.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STN3N45K3	3N45K3	SOT-223	Tube
STQ3N45K3-AP	3N45K3	TO-92	Ammopak
STU3N45K3	3N45K3	IPAK	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		SOT-223	TO-92	IPAK	
V_{DS}	Drain-source voltage (V_{GS} = 0)	450			V
V_{GS}	Gate- source voltage	± 30			V
I_D	Drain current (continuous) at T_C = 25 °C	0.6		1.8	A
I_D	Drain current (continuous) at T_C = 100 °C	0.38		1	A
I_{DM} (1)	Drain current (pulsed)	2.4		7.2	A
P_{TOT}	Total dissipation at T_C = 25 °C	2	2.5	27	W
T_{stg}	Storage temperature	-55 to 150			°C
T_j	Max. operating junction temperature	150			°C

1. Pulse width limited by safe operating area.

Table 3. Thermal data

Symbol	Parameter	SOT-223	TO-92	IPAK	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	62.50	50	4.63	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max			100	°C/W
T_l	Maximum lead temperature for soldering purpose	300			°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	0.5	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25°C, I_D = I_{AR}, V_{DD} = 50V)	TBD	mJ

2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	450			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C			1 50	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			± 10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 0.5 A		3.2	3.8	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	150 30 6	-	pF pF pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	TBD	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 360 V, I_D = 1.8 A, V_{GS} = 10 V (see *Figure 3*)	-	6 TBD TBD	-	nC nC nC

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off-delay time Fall time	V_{DD} = 225 V, I_D = 0.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 2*)	-	TBD TBD TBD TBD	-	ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		1.8 7.2	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 1.8 A, V_{GS} = 0	-		TBD	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 1.8 A, di/dt = 100 A/µs V_{DD} = 100 V (see *Figure 7*)	-	TBD TBD TBD		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 1.8 A, di/dt = 100 A/µs V_{DD} = 100 V, T_j = 150 °C (see *Figure 7*)	-	TBD TBD TBD		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%.

Table 9. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
BV_{GSO}	Gate-source breakdown voltage	Igs=± 1 mA (open drain)	30	-		V

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

3 Test circuits

Figure 2. Switching times test circuit for resistive load

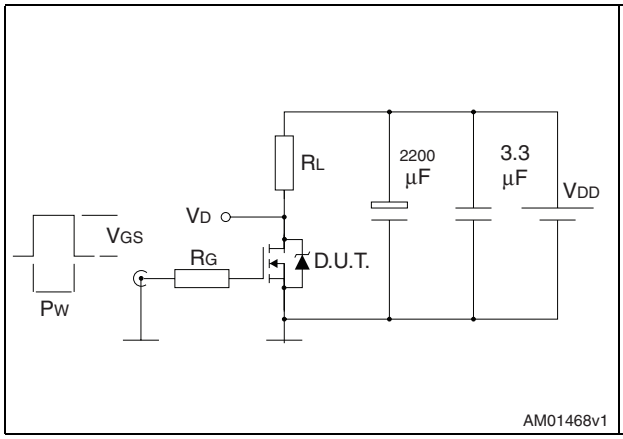


Figure 3. Gate charge test circuit

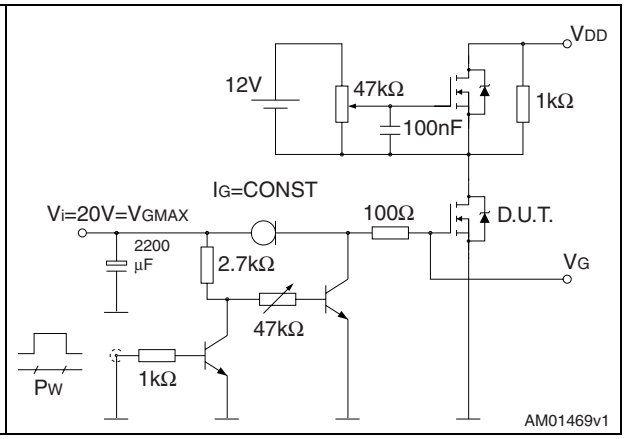


Figure 4. Test circuit for inductive load switching and diode recovery times

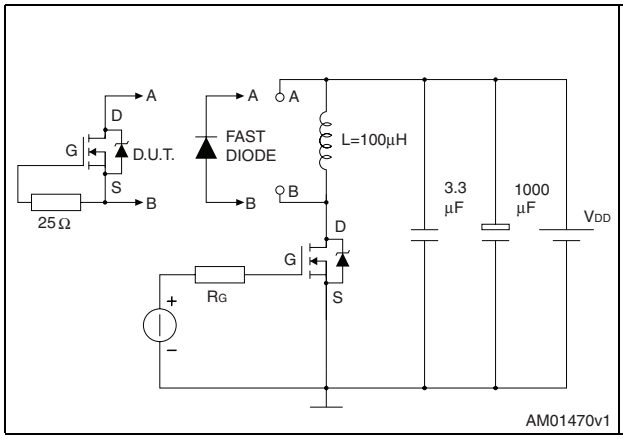


Figure 5. Unclamped Inductive load test circuit

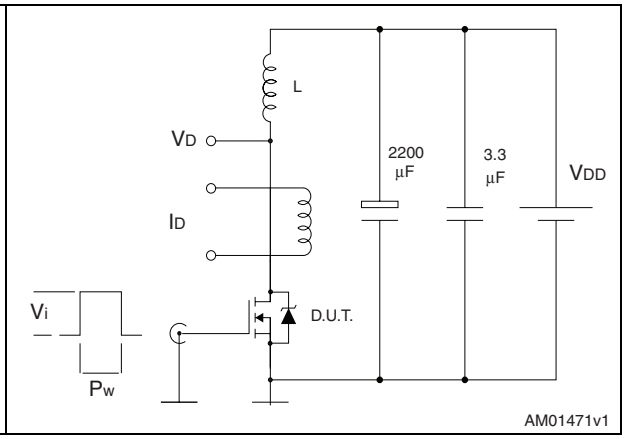


Figure 6. Unclamped inductive waveform

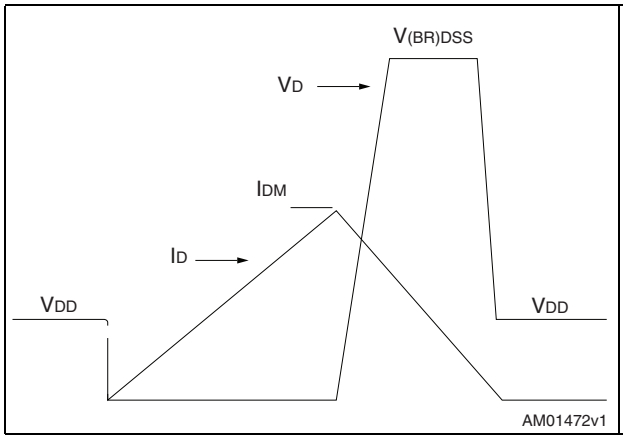
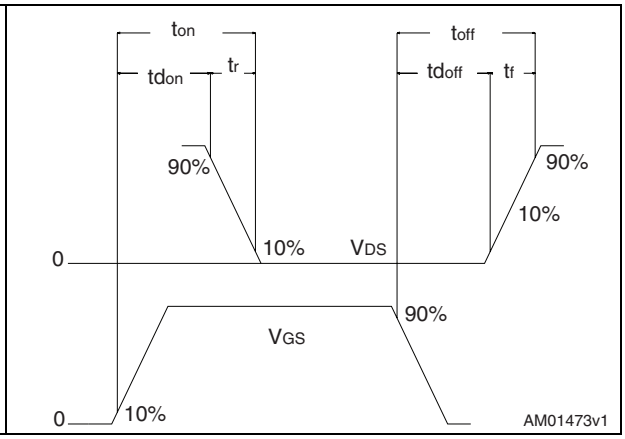


Figure 7. Switching time waveform



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.

SOT-223 mechanical data

DIM.	mm.		
	min.	typ	max.
A			1.80
A1	0.02		0.1
B	0.60	0.70	0.85
B1	2.90	3.00	3.15
c	0.24	0.26	0.35
D	6.30	6.50	6.70
e		2.30	
e1		4.60	
E	3.30	3.50	3.70
H	6.70	7.00	7.30
V			10 °

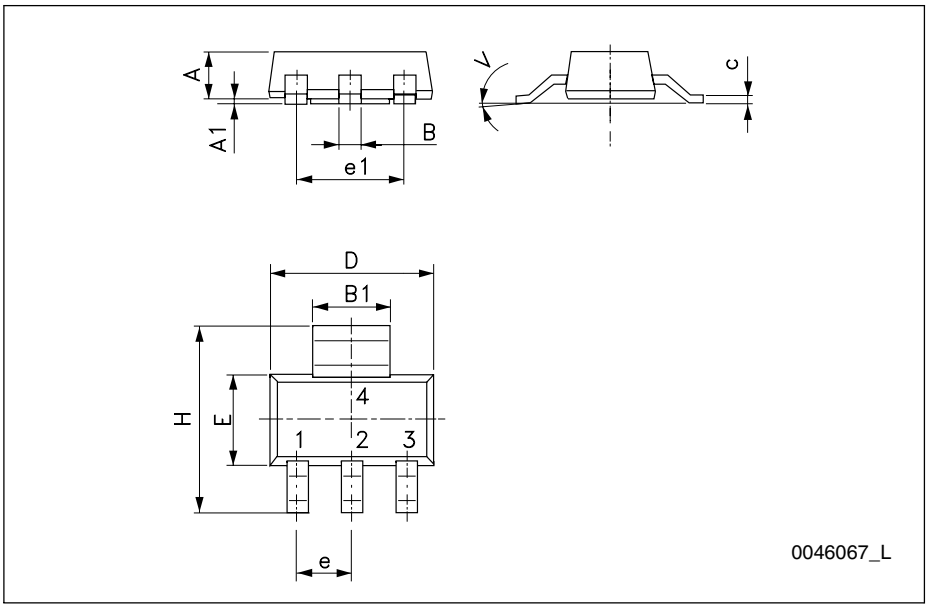
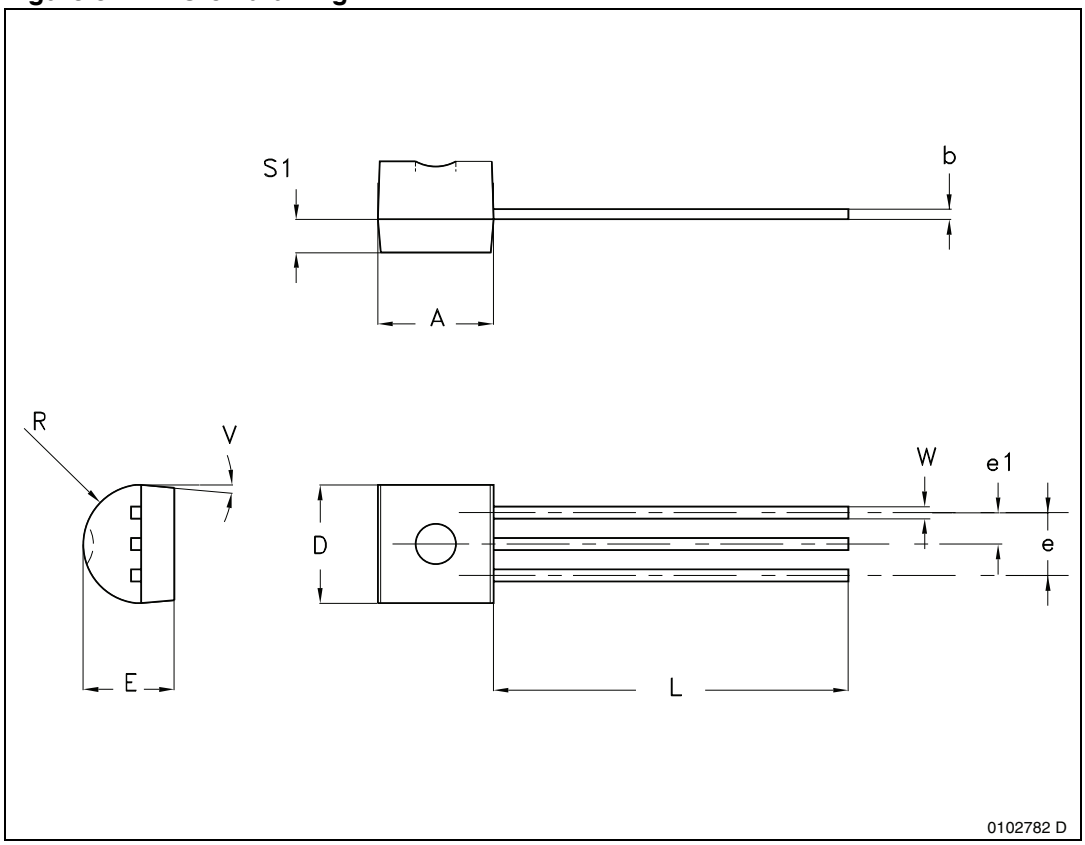


Table 10. TO-92 mechanical data

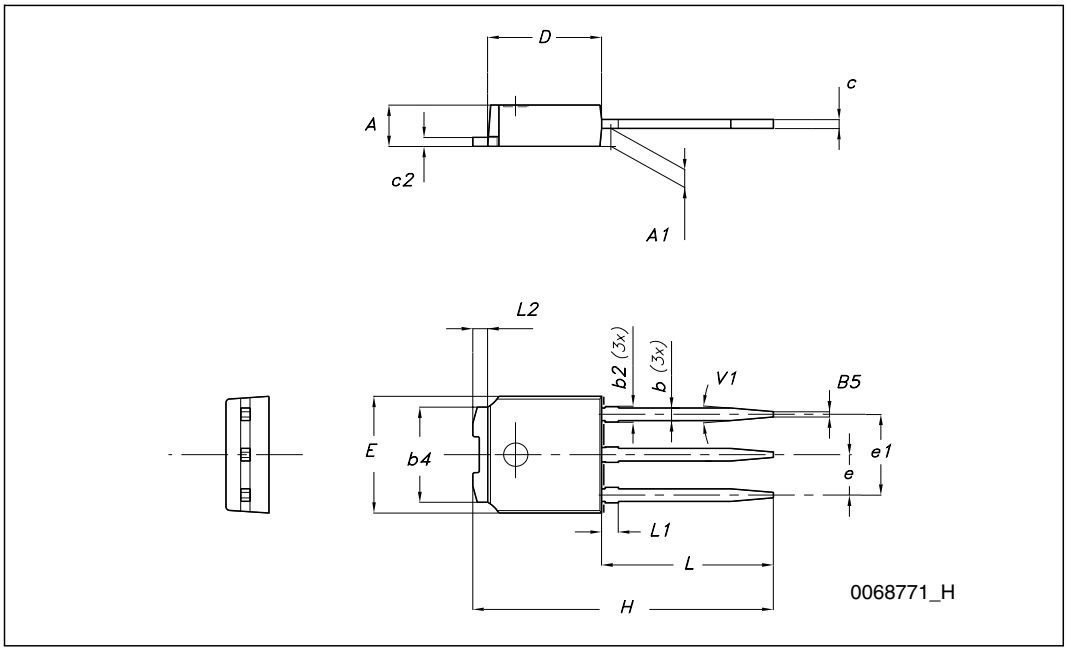
Dim.	mm		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

Figure 8. TO-92 drawing



TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10 °	



5 Revision history

Table 11. Document revision history

Date	Revision	Changes
02-Mar-2010	1	First release
23-Apr-2010	2	Changed root part number

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