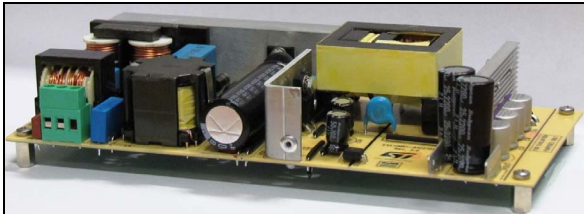


## 12 V - 210 W adapter based on STCMB1, combo TM PFC and HB LLC

Data brief



### Features

- Universal input mains voltage range:  
from 90 Vac to 264 Vac
  - frequency from 45 to 65 Hz
- Output voltage: 12 V at 17.5 A continuous operation
- Overall efficiency at full load: above 90%, well above **ENERGY STAR® 6.1** limit
- Average efficiency: > 90%, according to **European CoC ver. 5 Tier 2** for external power supplies
- Efficiency at 250 mW > 60%, well above **EuP lot 6 Tier 2** limit for household and office equipment
- No load mains consumption: < 90 mW, well below **European CoC ver. 5 Tier 2** limit for external power supplies
- Mains harmonics: meets EN61000-3-2 Class-D and JEITA-MITI Class-D
- EMI: according to EN55022 Class-B
- Safety: meets EN60950 standards
- RoHS compliant

### Description

The EVLCMB1-AIO210W demonstration board is a 12 V - 210 W converter, tailored for the typical specification of an AC/DC adapter for all-in-one systems, with a wide input mains range, very low power consumption at light load and good average efficiency.

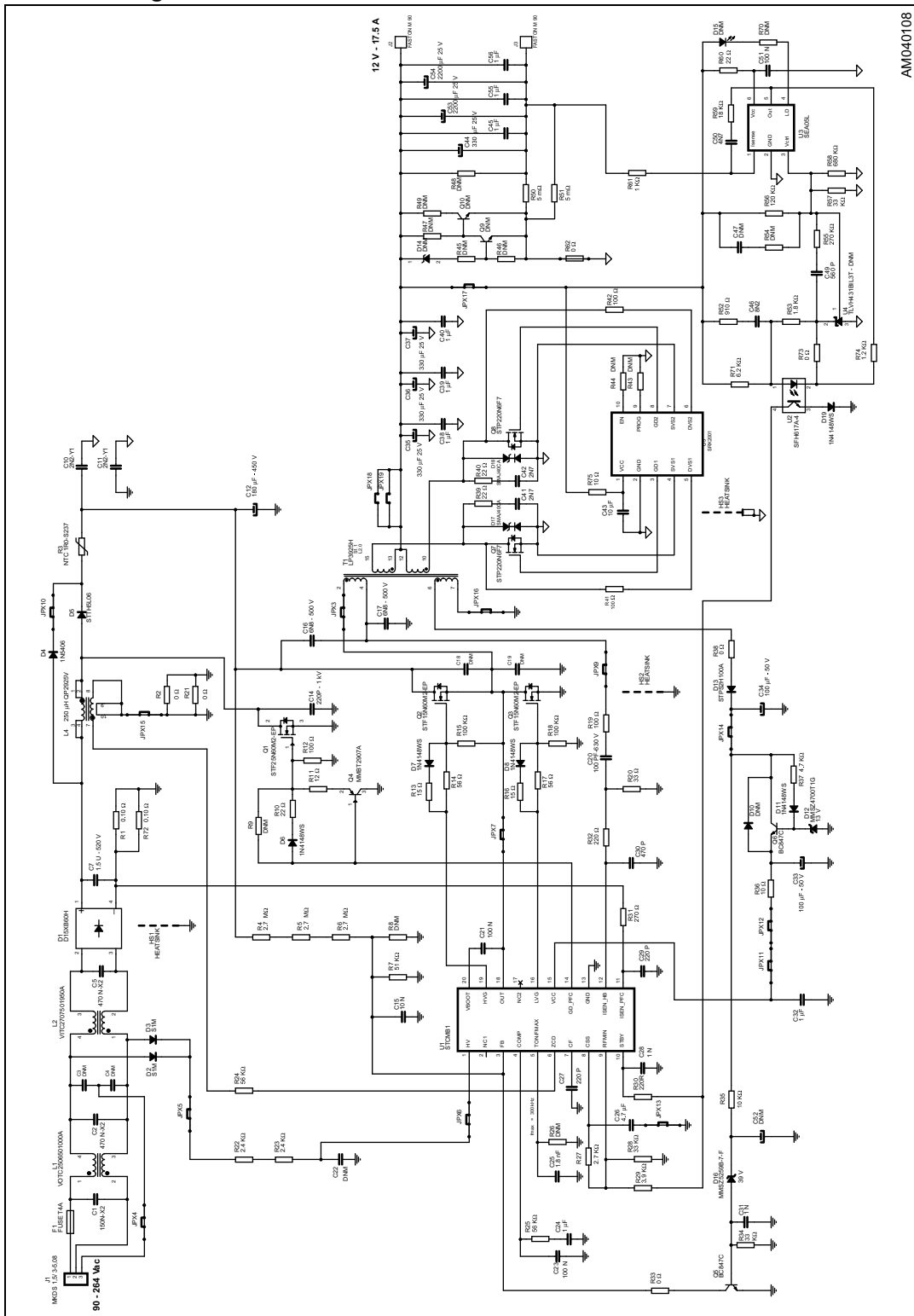
The architecture is based on a two-stage approach: a front-end transition mode PFC pre-regulator and a downstream LLC resonant half bridge converter; the PFC and LLC controllers are both integrated in the STCMB1 combo IC. At secondary side, synchronous rectification is implemented by means of the SRK2001. The PFC section uses a proprietary a constant-on-time control methodology that does not require a sinusoidal input reference, thereby reducing the system cost and external component count. The LLC section is based on a proprietary time shift control method that improves dynamic behavior and input ripple rejection resulting in a cleaner output voltage.

In the STCMB1 are also embedded a high voltage start up generator, an X-capacitor discharge circuit, the AC brownout/in function and a complete set of protections. These features are fully exploited in the EVLCMB1-AIO210W to make itself a robust and safe SMPS, for both the final user and the supplied system, while keeping a reduced external component count.

The EVLCMB1-AIO210W is characterized by very high efficiency at the light loads that comes from the careful design and selection of power components and by the burst mode management functions integrated in the STCMB1, including a proprietary IP that allows minimizing the number of cycles in the burst packet and so minimizing the switching losses.

# 1 Demonstration board schematic

Figure 1. EVLCMB1-AIO210W demonstration board schematic



## 2 Bill of material

Table 1. EVL CMB1-AIO210W BOM

Sch. ref.	Part no.	Case	Description	Supplier
C1	150 N - X2	6.0 x 18.0, p. 15 mm	X2 film cap. B32922C3154K	EPCOS
C2	470 N - X2	9.0 x 18.0, p. 15 mm	X2 film cap. B32922C3474K	EPCOS
C5	470 N - X2	9.0 x 18.0, p. 15 mm	X2 film cap. B32922C3474K	EPCOS
C7	1.5 U, 520 V	12.0 x 26.5.0, p. 22.5 mm	520 V film cap. B32673Z5155K	EPCOS
C10	2.2 N - Y1	P. 10 mm	Y1 safety cap. DE1E3KX222M	MURATA
C11	2.2 N - Y1	P. 10 mm	Y1 safety cap. DE1E3KX222M	MURATA
C12	180 $\mu$ F, 450 V	Dia. 18 x 50 mm	450 V alu. ELCAP BXW series 105 °C	RUBYCON
C14	220 P, 1 kV	1206	1000 V CERCAP	-
C15	10 N	0805	50 V CERCAP general purpose	AVX
C16	6.8 N, 500 V	6 x 10.3, p.7.5 mm	500 V MKP film cap. B32620A682J	EPCOS
C17	6.8 N, 500 V	6 x 10.3, p.7.5 mm	500 V MKP film cap. B32620A682J	EPCOS
C20	100 PF - 630 V	1206	630 V CERCAP GRM31A7U2J101JW31D	MURATA
C21	100 N	0805	50 V CERCAP general purpose	AVX
C23	100 N	0805	50 V CERCAP general purpose	AVX
C24	1 $\mu$ F	0805	50 V CERCAP X7R general purpose	TDK
C25	1.8 nF	0805	50 V CERCAP general purpose	AVX
C26	4.7 $\mu$ F	0805	10 V CERCAP general purpose	AVX
C27	220 P	0805	50 V 5% C0G CERCAP	AVX
C29	220 P	0805	50 V 5% C0G CERCAP	AVX
C28	1 N	0805	50 V CERCAP general purpose	AVX
C31	1 N	0805	50 V CERCAP general purpose	AVX
C30	470 P	0805	50 V 5% C0G CERCAP	AVX
C32	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C38	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C39	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C40	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C45	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C55	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C56	1 $\mu$ F	1206	50 V CERCAP X7R 10%	TDK
C33	100 $\mu$ F - 50 V	Dia. 8 x 11.5, p. 3.5 mm	Aluminium ELCAP YXF series 105 °C	RUBYCON
C34	100 $\mu$ F - 50 V	Dia. 8 x 11.5, p. 3.5 mm	Aluminium ELCAP YXF series 105 °C	RUBYCON
C35	330 $\mu$ F - 25 V	D.10.0 x H13.0, p. 5.0 mm	25 V OSCON ELCAP SEPF series 105 °C	PANASONIC

Table 1. EVLCMB1-AIO210W BOM (continued)

Sch. ref.	Part no.	Case	Description	Supplier
C36	330 $\mu$ F - 25 V	D.10.0 x H13.0, p. 5.0 mm	25 V OSCON ELCAP SEPF series 105 °C	PANASONIC
C37	330 $\mu$ F - 25 V	D.10.0 x H13.0, p 5.0mm	25 V OSCON ELCAP SEPF series 105 °C	PANASONIC
C44	330 $\mu$ F - 25 V	D.10.0 x H13.0, p 5.0mm	25 V OSCON ELCAP SEPF series 105 °C	PANASONIC
C41	2.7 N	0805	50 V CERCAP X7R general purpose	AVX
C42	2.7 N	0805	50 V CERCAP X7R general purpose	AVX
C43	10 $\mu$ F	1206	35 V CERCAP X5R general purpose	TDK
C46	8.2 N	0805	25 VCERCAP general purpose	AVX
C49	560 P	0805	50 V CERCAP general purpose	AVX
C50	4.7 N	0805	50 V 5% C0G CERCAP	AVX
C51	100 N	1206	50 V CERCAP general purpose	AVX
C53	2200 $\mu$ F - 25 V	D.12.5 x H30.0, p. 5.0 mm	25 V ALU ELCAP ZLH series 105 °C	RUBYCON
C54	2200 $\mu$ F - 25 V	D.12.5 x H30.0, p. 5.0 mm	25 V ALU ELCAP ZLH series 105 °C	RUBYCON
D1	D15XB60H	5S	Single phase bridge rectifier	SHINDENGEN
D2	S1M	DO214AC	General purpose rectifier, SMT	FAIRCHILD
D3	S1M	DO214AC	General purpose rectifier, SMT	FAIRCHILD
D4	1N5406	DO201	General purpose rectifier	VISHAY
D5	STTH5L06	DO201	Ultrafast high voltage rectifier	ST
D6	1N4148WS	SOD-323	High speed signal diode	VISHAY
D7	1N4148WS	SOD-323	High speed signal diode	VISHAY
D8	1N4148WS	SOD-323	High speed signal diode	VISHAY
D11	1N4148WS	SOD-323	High speed signal diode	VISHAY
D19	1N4148WS	SOD-323	High speed signal diode	VISHAY
D12	MMSZ4700T1G	SOD-123	Zener diode	DIODES
D13	STPS2H100A	SMA	Power Schottky diode	ST
D16	MMSZ5259B-7-F	SOD-123	Zener diode	DIODES
D17	SMAJ40CA	SMA	TVS diode SMAJ series	ST
D18	SMAJ40CA	SMA	TVS diode SMAJ series	ST
F1	Fuse T4A	8.5 x 4, p. 5.08 mm	FUSE 4A TIME LAG 3921400	LITTELFUSE
HS1	Heatsink	DWG	Heatsink for D1, Q1	-
HS2	Heatsink	DWG	Heatsink for Q2, Q3	-
HS3	Heatsink	DWG	Heatsink for Q7, Q8	-
JPX3	Shorted	-	Wire jumper	-
JPX5	Shorted	-	Wire jumper	-
JPX6	Shorted	-	Wire jumper	-

Table 1. EVLCMB1-AIO210W BOM (continued)

Sch. ref.	Part no.	Case	Description	Supplier
JPX7	Shorted	-	Wire jumper	-
JPX9	Shorted	-	Wire jumper	-
JPX10	Shorted	-	Wire jumper	-
JPX11	Shorted	-	Wire jumper	-
JPX12	Shorted	-	Wire jumper	-
JPX13	Shorted	-	Wire jumper	-
JPX14	Shorted	-	Wire jumper	-
JPX15	Shorted	-	Wire jumper	-
JPX16	Shorted	-	Wire jumper	-
JPX17	Shorted	-	Wire jumper	-
JPX4	Shorted	-	Wire jumper	-
JPX18	Shorted	-	Wire power jumper	-
JPX19	Shorted	-	Wire power jumper	-
J1	MKDS 1,5/ 3 -5,08	DWG	PCB screw conn. 5 MM, 3 W.	PHOENIX CONTACT
J2	FASTON M 90	DWG	FASTON connector	-
J3	FASTON M 90	DWG	FASTON connector	-
L1	VOTC2506501000 A	DWG	Toroidal EMI CM filter	YUJING
L2	VITC2707501950A	DWG	Toroidal EMI CM filter	YUJING
L4	QP2925V	DWG	PFC inductor 250 $\mu$ H	YUJING
Q1	STF25N60M2-EP	TO-220FP	N-channel power MOSFET	ST
Q2	STF15N60M2-EP	TO-220FP	N-channel power MOSFET	ST
Q3	STF15N60M2-EP	TO-220FP	N-channel power MOSFET	ST
Q4	MMBT2907A	SOT-23	PNP small signal BJT	VISHAY
Q5	BC847C	SOT-23	NPN small signal BJT	VISHAY
Q6	BC847C	SOT-23	NPN small signal BJT	VISHAY
Q7	STP220N6F7	TO-220	N-channel power MOSFET	ST
Q8	STP220N6F7	TO-220	N-channel power MOSFET	ST
R1	0R10	PTH RSMF1TB	Metal film res. 1 W, 2%, 200 ppm/ $^{\circ}$ C	AKANEOHM
R72	0.10 $\Omega$	PTH RSMF1TB	Metal film res. 1 W, 2%, 200 ppm/ $^{\circ}$ C	AKANEOHM
R2	0 $\Omega$	1206	SMD STD film res. 1/4 W, 5%, 200 ppm/ $^{\circ}$ C	VISHAY
R21	0 $\Omega$	1206	SMD STD film res. 1/4 W, 5% ,200 ppm/ $^{\circ}$ C	VISHAY
R38	0 $\Omega$	1206	SMD STD film res. 1/4 W, 5% ,200 ppm/ $^{\circ}$ C	VISHAY
R62	0 $\Omega$	1206	SMD STD film res. 1/4 W, 5%, 200 ppm/ $^{\circ}$ C	VISHAY

Table 1. EVLCMB1-AIO210W BOM (continued)

Sch. ref.	Part no.	Case	Description	Supplier
R73	0 Ω	1206	SMD STD film res. 1/4 W, 5%, 200 ppm/°C	VISHAY
R3	NTC 1R0-S237	Dia. 15 x 7 p. 7.5 mm	NTC resistor P/N B57237S0109M000	EPCOS
R4	2.7 MΩ	PTH	PTH STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R5	2.7 MΩ	1206	SMD STD film res. 1/4 W, 1%, 100 ppm/°C	VISHAY
R6	2.7 MΩ	1206	SMD STD film res. 1/4 W, 1%, 100 ppm/°C	VISHAY
R7	51 KΩ	0805	SMD STD film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R10	22 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R60	22 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R11	12 Ω	0805	SMD STD film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R12	100 KΩ	0805	SMD STD film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R15	100 KΩ	0805	SMD STD film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R18	100 KΩ	0805	SMD STD film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R13	15 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R16	15 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R14	56 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R17	56 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R19	100 Ω	0805	SMD STD film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R20	33 Ω	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R22	2.4 KΩ	1206	SMD std. film res. 1/4 W, 5%, 200 ppm/°C	VISHAY
R23	2.4 KΩ	1206	SMD std. film res. 1/4 W, 5%, 200 ppm/°C	VISHAY
R24	56 KΩ	1206	SMD std. film res. 1/4 W, 5%, 200 ppm/°C	VISHAY
R25	56 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R27	2.7 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R28	33 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R34	33 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R57	33 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R29	3.9 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY
R30	220 Ω	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R32	220 Ω	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R31	270 Ω	1206	SMD std. film res. 1/4 W, 5%, 200 ppm/°C	VISHAY
R33	0 Ω	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R35	10 KΩ	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R36	10 Ω	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/°C	VISHAY
R37	4.7 KΩ	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/°C	VISHAY

Table 1. EVLCMB1-AIO210W BOM (continued)

Sch. ref.	Part no.	Case	Description	Supplier
R39	22 $\Omega$	1206	SMD std. film res. 1/4 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R40	22 $\Omega$	1206	SMD std. film res. 1/4 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R41	100 $\Omega$	1206	SMD std. film res. 1/4 W, 1% ,100 ppm/ $^{\circ}$ C	VISHAY
R42	100 $\Omega$	1206	SMD std. film res. 1/4 W, 1% ,100 ppm/ $^{\circ}$ C	VISHAY
R50	5 m $\Omega$	2010	SMD current sense resistor WSLP	VISHAY
R51	5 m $\Omega$	2010	SMD current sense resistor WSLP	VISHAY
R52	910 $\Omega$	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R53	1.8 K $\Omega$	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/ $^{\circ}$ C	VISHAY
R55	270 K $\Omega$	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R56	120 K $\Omega$	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R58	680 K $\Omega$	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R59	18 K $\Omega$	0805	SMD std. film res. 1/8 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
R61	1 K $\Omega$	1206	SMD std. film res. 1/4 W, 1%,100 ppm/ $^{\circ}$ C	VISHAY
R71	6.2 K $\Omega$	0805	SMD std. film res. 1/8 W, 5%, 200 ppm/ $^{\circ}$ C	VISHAY
R74	1.2 K $\Omega$	1206	SMD std. film res. 1/4 W, 5%, 200 ppm/ $^{\circ}$ C	VISHAY
R75	10 $\Omega$	1206	SMD std. film res. 1/4 W, 1%, 100 ppm/ $^{\circ}$ C	VISHAY
T1	LP3925H	DWG	Resonant transformer LP3925H	YUJING
U1	STCMB1	SO20W	TM PFC and HB LLC res. COMBO contr.	ST
U2	SFH617A-4	DIP-4 10.16 MM	Optocoupler	VISHAY
U3	SEA05L	SOT23-6L	CV/CC contr. with LED driver	ST
U5	SRK2001	SSOP10	SRK2001 SR controller	ST

### 3 Revision history

Table 2. Document revision history

Date	Revision	Changes
08-Jun-2017	1	Initial release.



**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2017 STMicroelectronics – All rights reserved

