

### Features

- Eight Darlington transistors with common emitters
- Output current to 500 mA
- Output voltage to 50 V
- Integral suppression diodes
- Versions for all popular logic families
- Output can be paralleled
- Inputs pinned opposite outputs to simplify board layout

### Description

The ULN2801A, ULN2802A, ULN2803A and ULN2804A each contain eight Darlington transistors with common emitters and integral suppression diodes for inductive loads. Each Darlington features a peak load current rating of 600 mA (500 mA continuous) and can withstand at least 50 V in the OFF state. Outputs may be paralleled for higher current capability.

Four versions are available to simplify interfacing to standard logic families: the ULN2801A is designed for general purpose applications with a current limit resistor; the ULN2802A has a 10.5 k $\Omega$  input resistor and Zener for 14-25 V PMOS; the ULN2803A has a 2.7 k $\Omega$  input resistor for 5 V TTL and CMOS; the ULN2804A has a 10.5 k $\Omega$  input resistor for 6-15 V CMOS.

All types are supplied in an 18-lead plastic DIP with a copper lead form and feature the convenient input-opposite-output pinout to simplify board layout.

**Table 1. Device summary**

Order codes	Package
ULN2801A	DIP-18
ULN2802A	
ULN2803A	
ULN2804A	

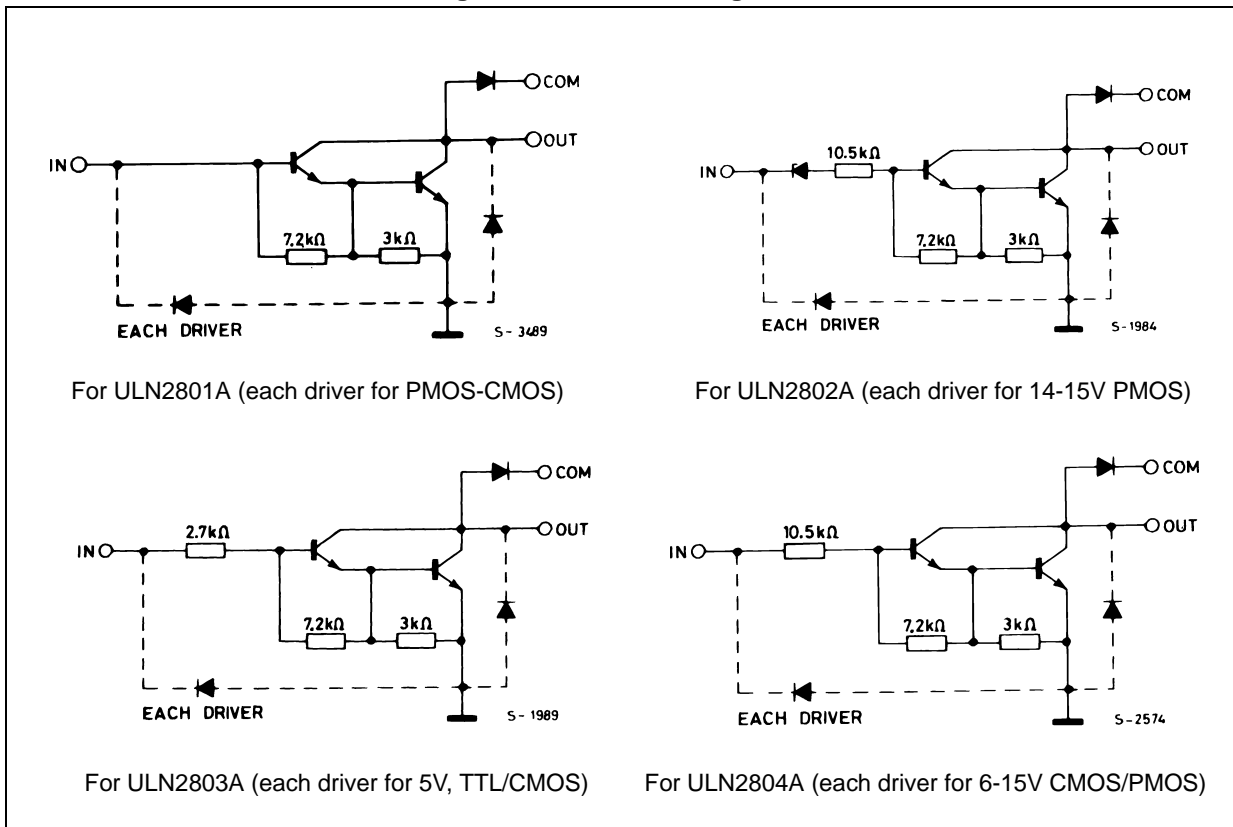
# Contents

1	Diagram .....	3
2	Pin configuration .....	4
3	Maximum ratings .....	5
4	Electrical characteristics .....	6
5	Test circuits .....	7
6	Typical performance characteristics .....	9
7	Package mechanical data .....	11
8	Revision history .....	13



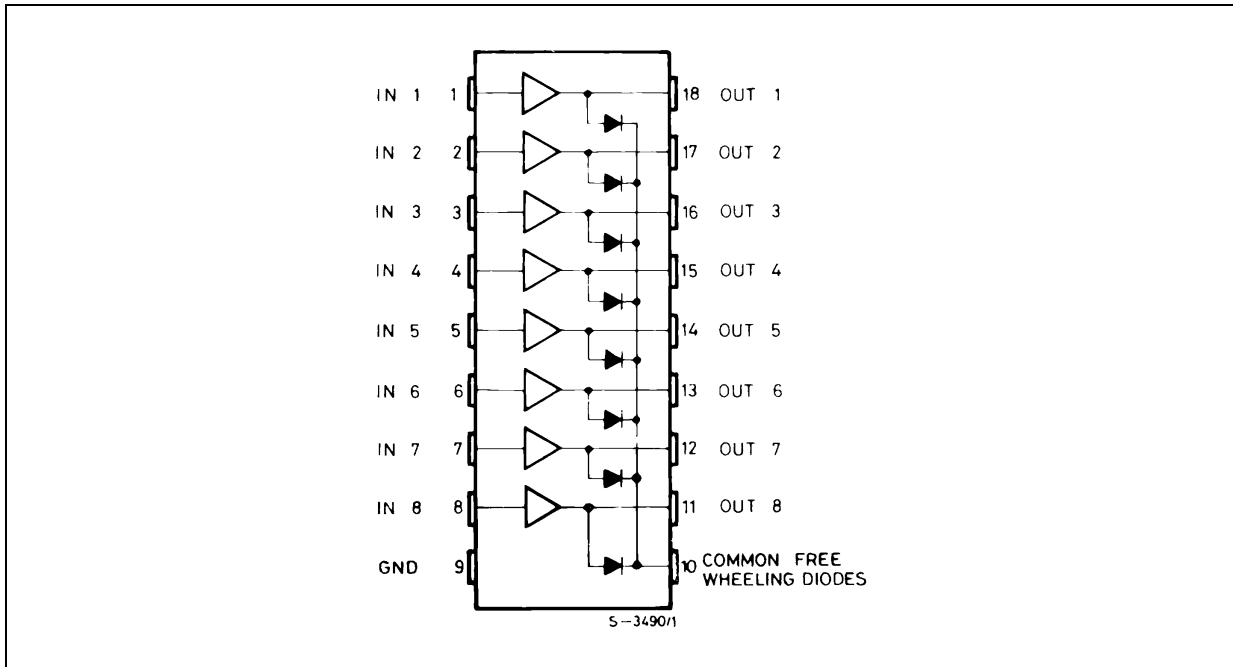
# 1 Diagram

Figure 1. Schematic diagrams



## 2 Pin configuration

Figure 2. Pin connections (top view)



### 3 Maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_O$	Output voltage	50	V
$V_I$	Input voltage (for ULN2802A - ULN2803A - ULN2804A)	30	V
$I_C$	Continuous collector current	500	mA
$I_B$	Continuous base current	25	mA
$P_{TOT}$	Power Dissipation (one Darlington pair)	1	W
	Power Dissipation (total package)	2.25	
$T_A$	Operating ambient temperature range	- 20 to 85	°C
$T_{STG}$	Storage temperature range	- 55 to 150	°C
$T_J$	Junction temperature	-20 to 150	°C

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJA}$	Thermal resistance junction-ambient	55	°C/W

## 4 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$I_{CEX}$	Output leakage current	$V_{CE} = 50\text{ V}$				$\mu\text{A}$
		$T_A = 70\text{ °C}$ , $V_{CE} = 50\text{ V}$ (Figure 3)			50	
		$T_A = 70\text{ °C}$ for ULN2802A, $V_{CE} = 50\text{ V}$ , $V_I = 6\text{ V}$ (Figure 4)			100	
		$T_A = 70\text{ °C}$ for ULN2804A, $V_{CE} = 50\text{ V}$ , $V_I = 1\text{ V}$ (Figure 4)			500	
$V_{CE(SAT)}$	Collector-emitter saturation voltage (Figure 5)	$I_C = 100\text{ mA}$ , $I_B = 250\text{ }\mu\text{A}$		0.9	1.1	V
		$I_C = 200\text{ mA}$ , $I_B = 350\text{ }\mu\text{A}$		1.1	1.3	
		$I_C = 350\text{ mA}$ , $I_B = 500\text{ }\mu\text{A}$		1.3	1.6	
$I_{I(ON)}$	Input current (Figure 6)	for ULN2802A, $V_I = 17\text{ V}$		0.82	1.25	mA
		for ULN2803A, $V_I = 3.85\text{ V}$		0.93	1.35	
		for ULN2804A, $V_I = 5\text{ V}$		0.35	0.5	
		$V_I = 12\text{ V}$		1	1.45	
$I_{I(OFF)}$	Input current (Figure 7)	$T_A = 70\text{ °C}$ , $I_C = 500\text{ }\mu\text{A}$	50	65		$\mu\text{A}$
$V_{I(ON)}$	Input voltage (Figure 8)	$V_{CE} = 2\text{ V}$ , for ULN2802A			13	V
		$I_C = 300\text{ mA}$			2.4	
		for ULN2803A			2.7	
		$I_C = 200\text{ mA}$			3	
		$I_C = 250\text{ mA}$			5	
		for ULN2804A			6	
		$I_C = 125\text{ mA}$			7	
		$I_C = 200\text{ mA}$			8	
$I_C = 275\text{ mA}$						
$I_C = 350\text{ mA}$						
$h_{FE}$	DC Forward current gain (Figure 5)	for ULN2801A, $V_{CE} = 2\text{ V}$ , $I_C = 350\text{ mA}$	1000			
$C_I$	Input capacitance			15	25	pF
$t_{PLH}$	Turn-on delay time	$0.5 V_I$ to $0.5V_O$		0.25	1	$\mu\text{s}$
$t_{PHL}$	Turn-off delay time	$0.5 V_I$ to $0.5V_O$		0.25	1	$\mu\text{s}$
$I_R$	Clamp diode leakage current (Figure 9)	$V_R = 50\text{ V}$			50	$\mu\text{A}$
		$T_A = 70\text{ °C}$ , $V_R = 50\text{ V}$			100	
$V_F$	Clamp diode forward voltage (Figure 10)	$I_F = 350\text{ mA}$		1.7	2	V

## 5 Test circuits

Figure 3. Output leakage current

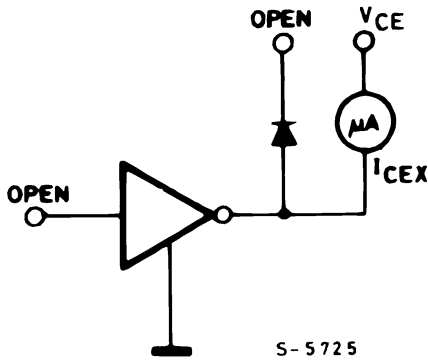


Figure 4. Output leakage current (for ULN2802A only)

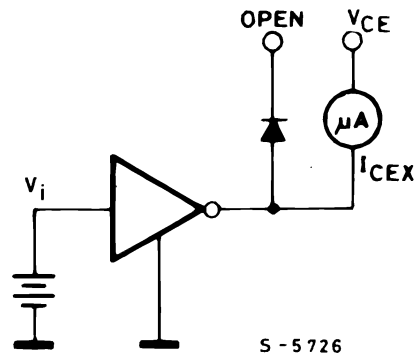


Figure 5. Collector-emitter saturation voltage

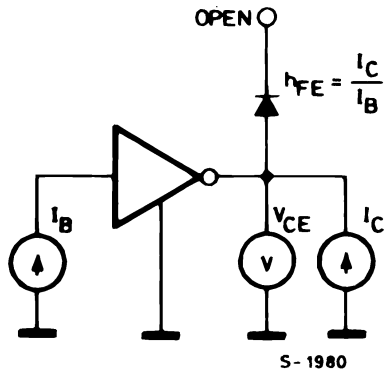


Figure 6. Input current (ON)

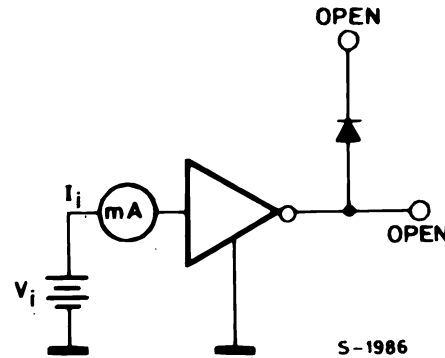


Figure 7. Input current (OFF)

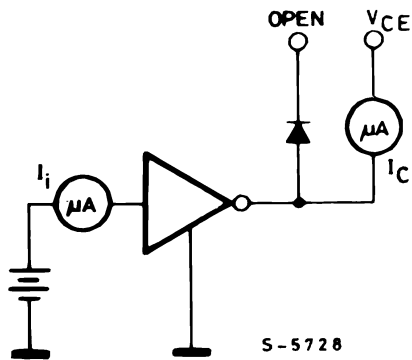


Figure 8. Input voltage

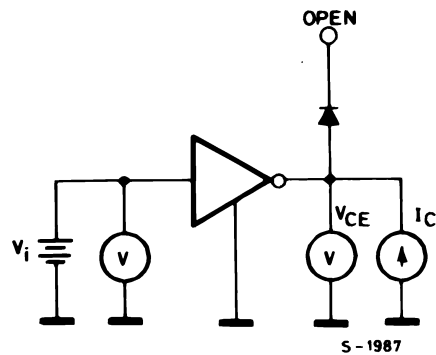


Figure 9. Clamp diode leakage current

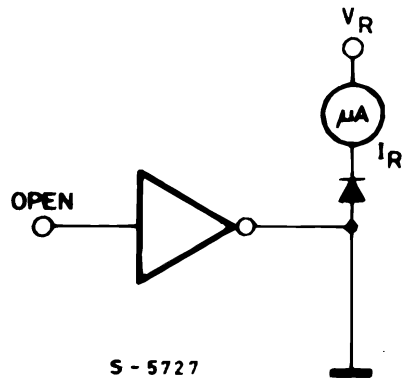
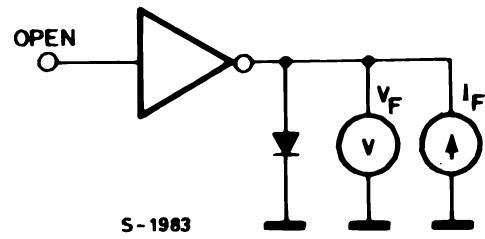


Figure 10. Clamp diode forward voltage





## 6 Typical performance characteristics

Figure 11. Collector current as a function of saturation voltage

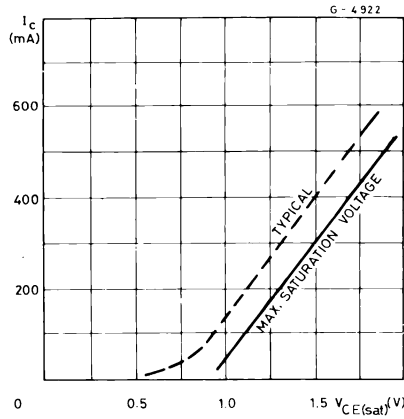


Figure 12. Collector current as a function of input current

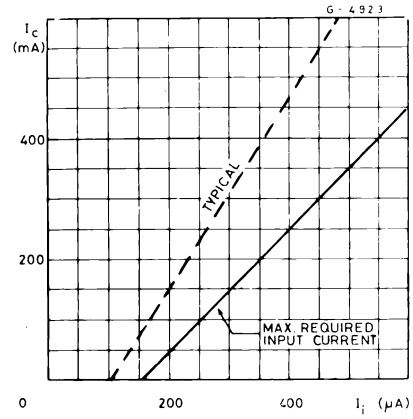


Figure 13. Allowable average power dissipation as a function of  $T_A$

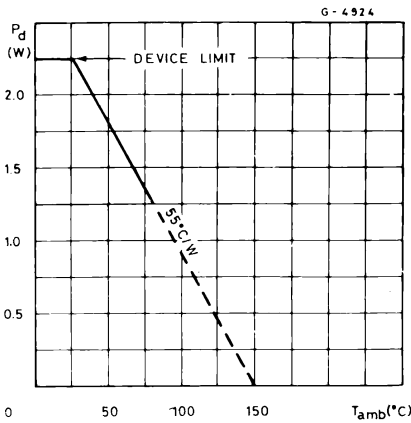
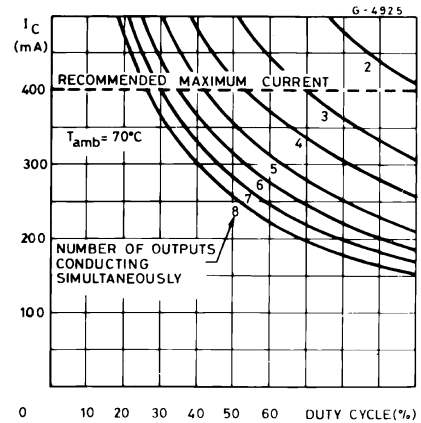
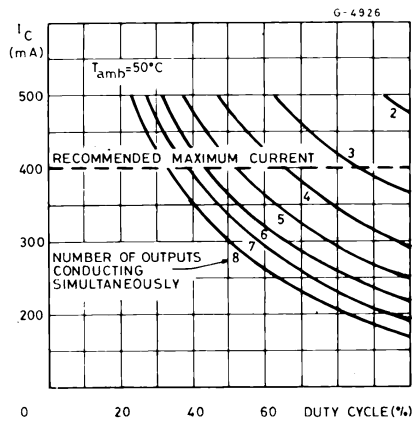


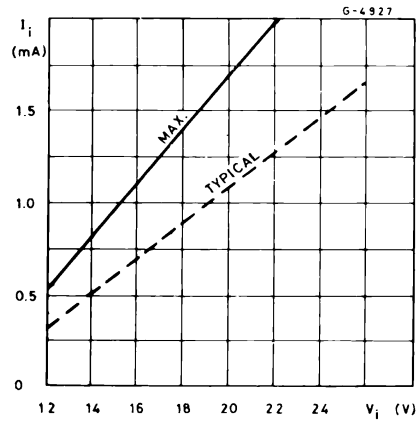
Figure 14. Peak collector current as a function of duty cycle



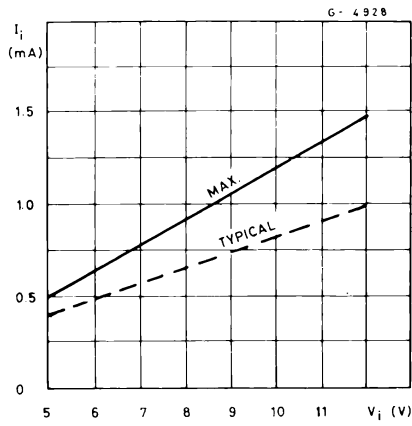
**Figure 15. Peak collector current as a function of duty cycle**



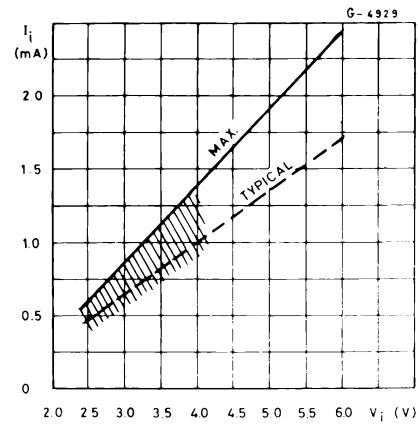
**Figure 16. Input current as a function of input voltage (for ULN2802A)**



**Figure 17. Input current as a function of input voltage (for ULN2804A)**



**Figure 18. Input current as a function of input voltage (for ULN2803A)**



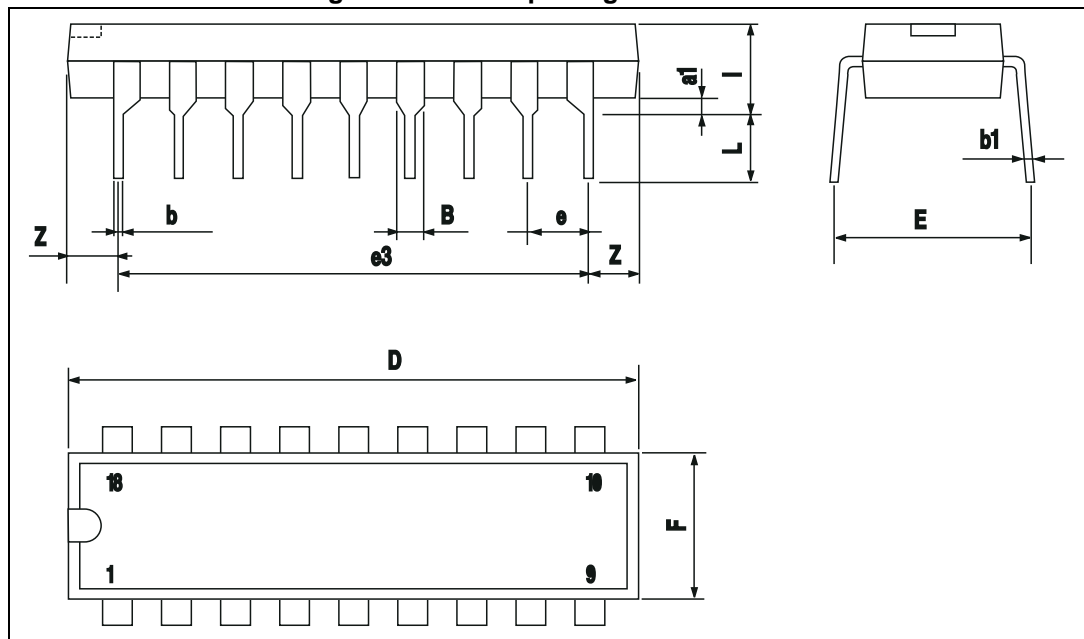
## 7 Package mechanical data

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

Table 5. DIP-18 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
a1	0.254		
B	1.39		1.65
b		0.46	
b1		0.25	
D			23.24
E		8.5	
e		2.54	
e3		20.32	
F			7.1
I			3.93
L		3.3	
Z		1.27	1.59

Figure 19. DIP-18 package dimensions



## 8 Revision history

**Table 6. Document revision history**

Date	Revision	Changes
18-Sep-2003	1	First release
10-Mar-2010	2	Updated package mechanical data
19-Nov-2012	3	Modified input voltage values Table 4 on page 6.
27-Jun-2018	4	Updated: $I_{I(ON)}$ test condition in <a href="#">Table 4: Electrical characteristics</a> .

**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.

© 2018 STMicroelectronics – All rights reserved