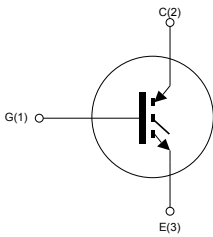

**TO-3PF**


SC12650



### Features

- Optimized performance for medium operating frequencies up to 5 kHz in hard switching
- Low on-voltage drop ( $V_{CE(sat)}$ )
- High current capability

### Applications

- Motor drive

### Description

This device utilizes the advanced PowerMESH process resulting in an excellent trade-off between switching performance and low on-state behavior.

#### Product status link

[STGWF30NC60S](#)

#### Product summary

<b>Order code</b>	STGWF30NC60S
<b>Marking</b>	G30NC60S
<b>Package</b>	TO-3PF
<b>Packing</b>	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>GE</sub> = 0 V)	600	V
I <sub>C</sub> <sup>(1)</sup>	Continuous collector current at T <sub>C</sub> = 25 °C	35	A
	Continuous collector current at T <sub>C</sub> = 100 °C	18	
I <sub>CL</sub> <sup>(2)</sup>	Turn-off latching current	150	A
I <sub>CP</sub> <sup>(3)</sup>	Pulsed collector current	150	A
V <sub>GE</sub>	Gate-emitter voltage	±20	V
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T <sub>C</sub> = 25 °C)	2.5	kV
P <sub>TOT</sub>	Total power dissipation at T <sub>C</sub> = 25 °C	79	W
T <sub>J</sub>	Operating junction temperature range	- 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. V<sub>clamp</sub> = 80%.(V<sub>CES</sub>), T<sub>J</sub> = 150 °C, R<sub>G</sub> = 10 Ω, V<sub>GE</sub> = 15 V.
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
R <sub>thJC</sub>	Thermal resistance junction-case	1.58	°C/W
R <sub>thJA</sub>	Thermal resistance junction-ambient	50	°C/W

## 2 Electrical characteristics

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

**Table 3. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$		1.5	1.9	V
		$V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_J = 150\text{ °C}$		1.4		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
$I_{CES}$	Collector cut-off current	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$			150	$\mu\text{A}$
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ °C}$			1	mA
$I_{GES}$	Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 100$	nA
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15\text{ V}, I_C = 20\text{ A}$		10		S

1. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	2200	-	pF
$C_{oes}$	Output capacitance		-	185	-	
$C_{res}$	Reverse transfer capacitance		-	48.5	-	
$Q_g$	Total gate charge	$V_{CC} = 480\text{ V}, I_C = 20\text{ A}, V_{GE} = 15\text{ V}$ (see Figure 16. Gate charge test circuit)	-	96	-	nC
$Q_{ge}$	Gate-emitter charge		-	14	-	
$Q_{gc}$	Gate-collector charge		-	44.5	-	

**Table 5. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480\text{ V}$ , $I_C = 20\text{ A}$ ,	-	21.5	-	ns
$t_r$	Current rise time	$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$	-	8.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 15. Test circuit for inductive load switching)	-	2280	-	A/ $\mu$ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480\text{ V}$ , $I_C = 20\text{ A}$ ,	-	20.5	-	ns
$t_r$	Current rise time	$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	9.5	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 15. Test circuit for inductive load switching)	-	2150	-	A/ $\mu$ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 480\text{ V}$ , $I_C = 20\text{ A}$ ,	-	85	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$	-	180	-	ns
$t_f$	Current fall time	(see Figure 15. Test circuit for inductive load switching)	-	200	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 480\text{ V}$ , $I_C = 20\text{ A}$ ,	-	155	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	260	-	ns
$t_f$	Current fall time	(see Figure 15. Test circuit for inductive load switching)	-	295	-	ns

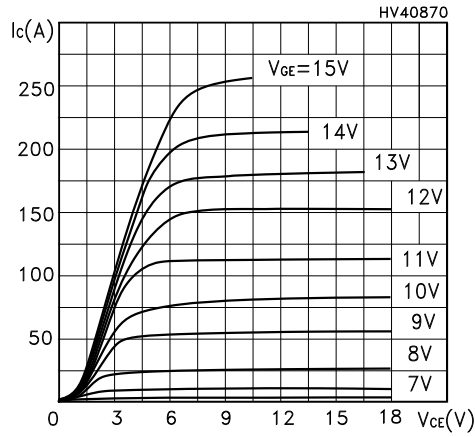
**Table 6. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching energy	$V_{CE} = 480\text{ V}$ , $I_C = 20\text{ A}$ ,	-	300	-	$\mu$ J
$E_{off}$	Turn-off switching energy	$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$	-	1275	-	$\mu$ J
$E_{ts}$	Total switching energy	(see Figure 15. Test circuit for inductive load switching)	-	1575	-	$\mu$ J
$E_{on}$	Turn-on switching energy	$V_{CE} = 480\text{ V}$ , $I_C = 20\text{ A}$ ,	-	430	-	$\mu$ J
$E_{off}$	Turn-off switching energy	$R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ }^\circ\text{C}$	-	1965	-	$\mu$ J
$E_{ts}$	Total switching energy	(see Figure 15. Test circuit for inductive load switching)	-	2395	-	$\mu$ J

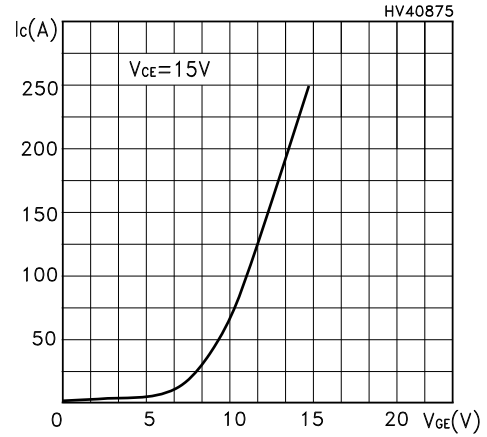
1. Turn-off losses include also the tail of the collector current.

## 2.1 Electrical characteristics (curves)

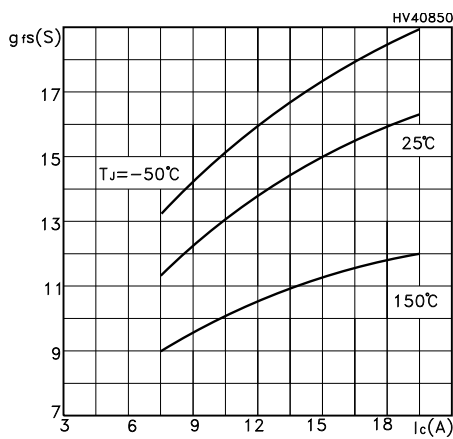
**Figure 1. Output characteristics**



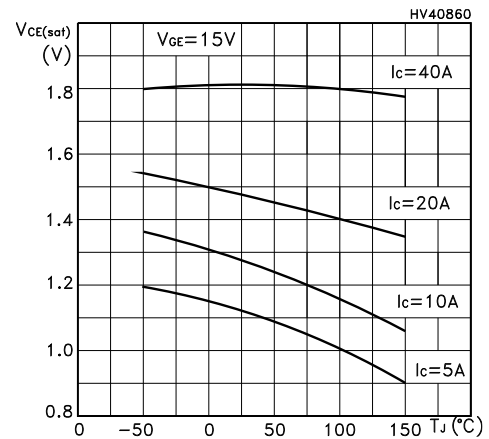
**Figure 2. Transfer characteristics**



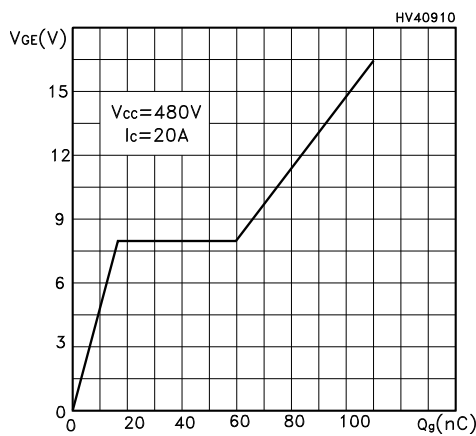
**Figure 3. Transconductance**



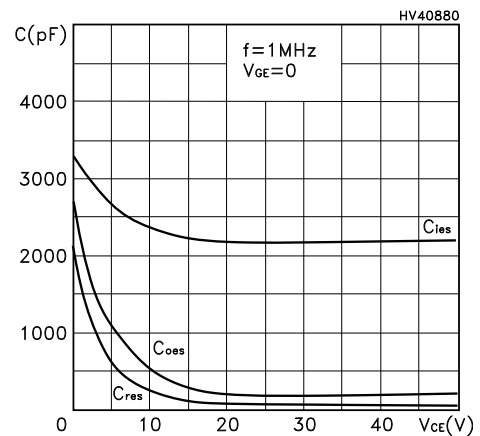
**Figure 4. Collector-emitter on voltage vs temperature**



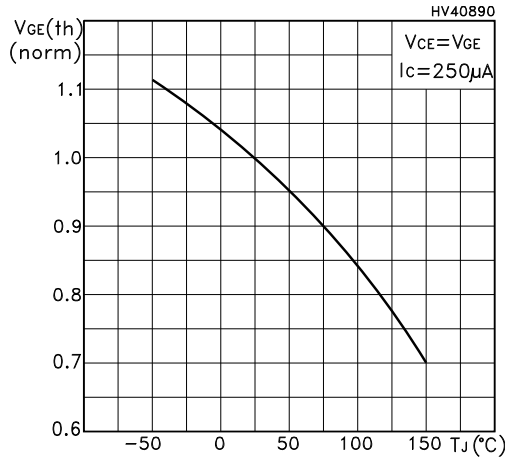
**Figure 5. Gate charge vs gate-source voltage**



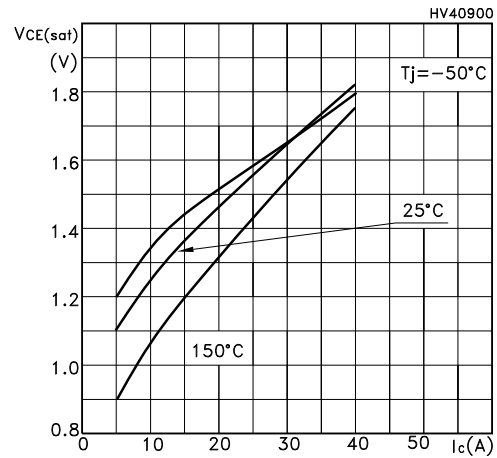
**Figure 6. Capacitance variations**



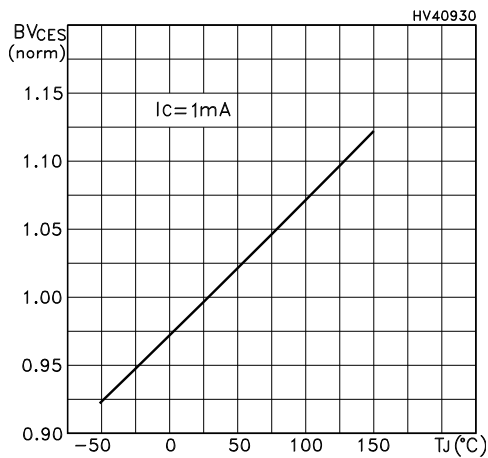
**Figure 7. Normalized gate threshold voltage vs temperature**



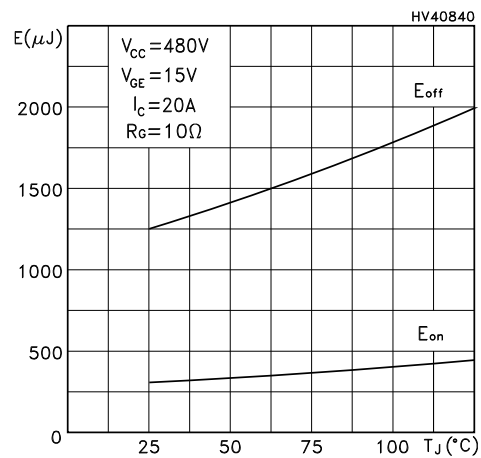
**Figure 8. Collector-emitter on voltage vs collector current**



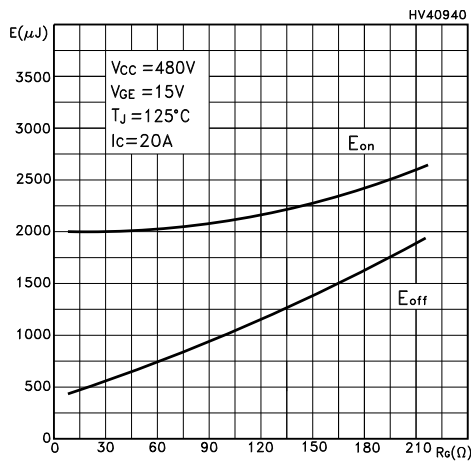
**Figure 9. Normalized breakdown voltage vs temperature**



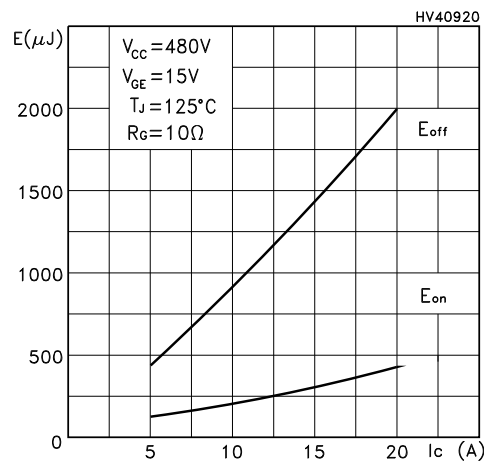
**Figure 10. Switching losses vs temperature**



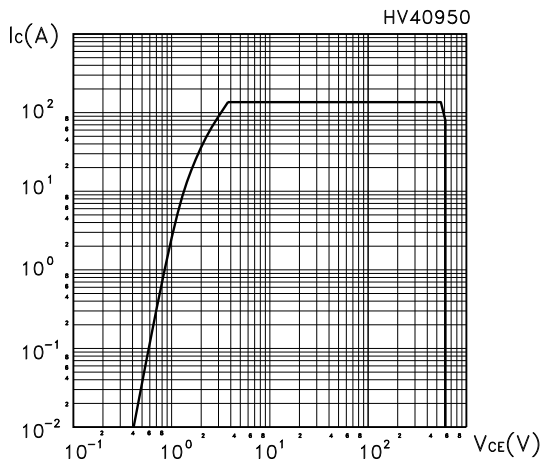
**Figure 11. Switching losses vs gate resistance**



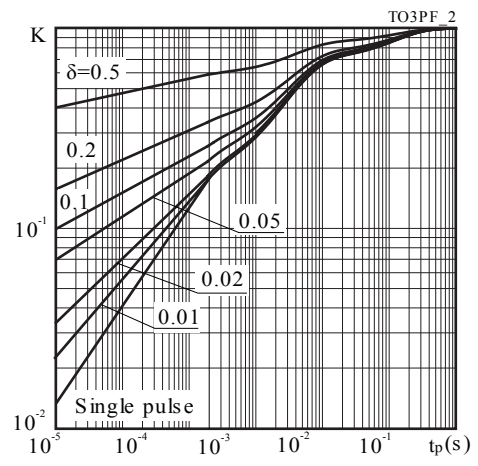
**Figure 12. Switching losses vs collector current**



**Figure 13. Turn-off SOA**



**Figure 14. Thermal Impedance**





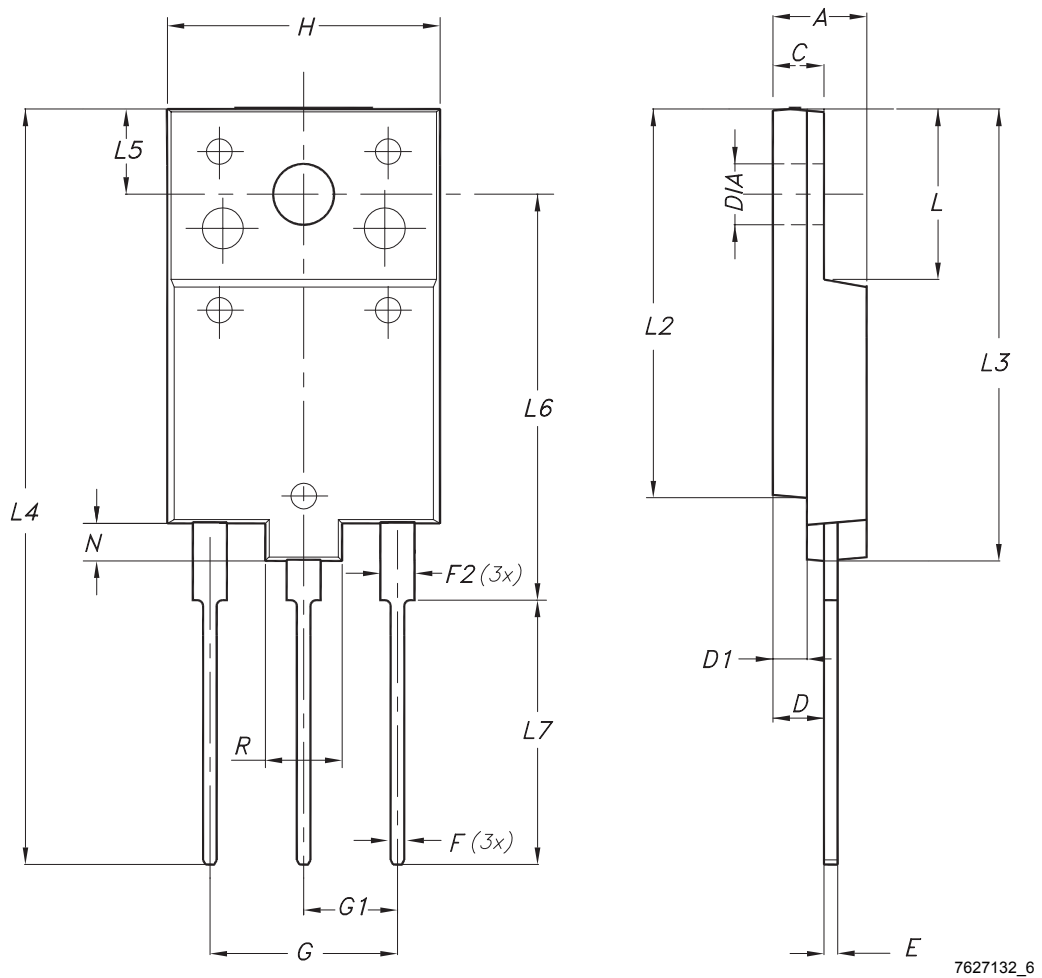


## 4 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 TO-3PF package information

Figure 18. TO-3PF package outline



**Table 7. TO-3PF mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10.00	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15.00
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

## Revision history

**Table 8. Document revision history**

Date	Revision	Changes
02-Jul-2007	1	Initial release
20-Nov-2007	2	Document status promoted from preliminary data to datasheet
04-May-2009	3	Added new package, mechanical data: TO-220FP
30-Jun-2010	4	Added new package, mechanical data: TO-3PF
11-Nov-2010	5	<ul style="list-style-type: none"> <li>– Updated data for TO-3PF in <i>Table 2</i> and <i>Table 3</i></li> <li>– Modified <i>Figure 17</i></li> </ul>
04-May-2020	6	<p>The part numbers STGF30NC60S and STGP30NC60S have been moved to a separate datasheet and the document has been updated accordingly.</p> <p>Updated <a href="#">Device summary</a>.</p>

---

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>2</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>3</b>
<b>2.1</b>	<b>Electrical characteristics (curves)</b> .....	<b>5</b>
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package information</b> .....	<b>9</b>
<b>4.1</b>	<b>TO-3PF package information</b> .....	<b>9</b>
	<b>Revision history</b> .....	<b>11</b>

**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. For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks). 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.

© 2020 STMicroelectronics – All rights reserved