

Octal channel high-side driver

Datasheet - production data



- Protection against loss of ground
- Very low standby current
- Compliance to 61000-4-4 IEC test up to 4 kV

Description

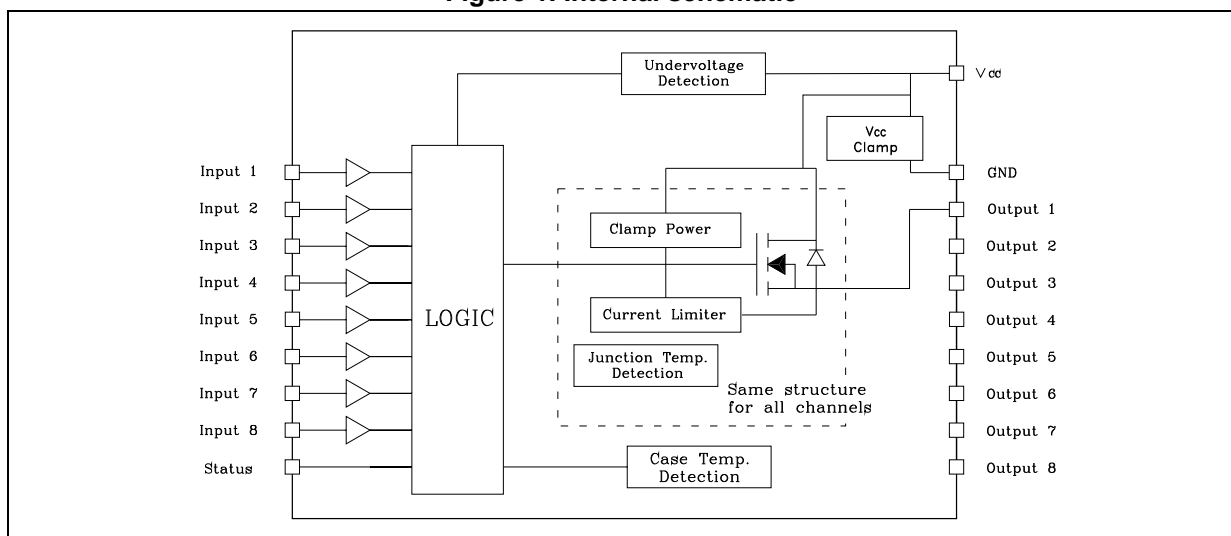
The VN808-E is a monolithic device, realized in STMicroelectronics VIPower M0-3 technology, intended to drive any kind of load with one side connected to ground. Active current limitation combined with thermal shutdown and automatic restart, protect the device against overload. In overload conditions, the channel turns OFF and ON again automatically in order to maintain the junction temperature between T_{TSD} and T_R . If this condition makes case temperature reach T_{CSD} , overloaded channels are turned OFF and restart only when case temperature decreases down to T_{CR} . Non-overloaded channels continue to operate normally. The device automatically turns OFF in case of ground pin disconnection. This device is especially suitable for industrial applications conform to IEC 61131.

Features

Type	$R_{DS(on)}^{(1)}$	I_{OUT}	V_{CC}
VN808-E	150 m Ω	0.7 A	45 V

1. Per channel

- $V_{CC}/2$ compatible input
- Junction overtemperature protection
- Case overtemperature protection for thermal independence of the channels
- Current limitation
- Short-circuit load protection
- Undervoltage shutdown

Figure 1. Internal schematic


Contents

1	Maximum ratings	3
2	Electrical characteristics	4
3	Pin connections	6
4	Current, voltage conventions and internal diagram	8
5	Switching time waveforms	10
6	Reverse polarity protection	13
7	Package mechanical data	14
	7.1 Footprint recommended data	16
	7.2 Tube shipment information	17
	7.3 Tape and reel shipment information	18
8	Ordering information	20
9	Revision history	21

1 Maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	DC supply voltage	45	V
$-I_{GND}$	DC ground reverse current TRAN ground reverse current (pulse duration < 1 ms)	-250 -6	mA A
I_{OUT}	DC output current	Internally limited	A
$-I_{OUT}$	Reverse DC output current	-2	A
I_{IN}	DC input current	± 10	mA
V_{IN}	Input voltage range	$-3/+V_{CC}$	V
V_{ESD}	Electrostatic discharge (R = 1.5 k Ω ; C = 100 pF)	2000	V
P_{TOT}	Power dissipation at $T_C = 25\text{ }^\circ\text{C}$	96	W
L_{MAX}	Max. inductive load ($V_{CC} = 24\text{ V}$, $R_{LOAD} = 48\text{ }\Omega$, $T_A = 100\text{ }^\circ\text{C}$)	2	H
T_J	Junction operating temperature	Internally limited	$^\circ\text{C}$
T_C	Case operating temperature	Internally limited	$^\circ\text{C}$
T_{STG}	Storage temperature	-40 to 150	$^\circ\text{C}$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{th(JC)}$	Thermal resistance junction-case	Max. 1.3	$^\circ\text{C}/\text{W}$
$R_{th(JA)}$	Thermal resistance junction-ambient ⁽¹⁾	Max. 50	$^\circ\text{C}/\text{W}$

1. When mounted on FR4 printed circuit board with 0.5 cm² of copper area (at least 35 μm thick) connected to all TAB pins.

2 Electrical characteristics

10.5 V < V_{CC} < 32 V; - 40 °C < T_J < 125 °C; unless otherwise specified.

Table 3. Power section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{CC}	Operating supply voltage		10.5		45	V
V _{USD}	Undervoltage shutdown		7		10.5	V
R _{ON}	On-state resistance	I _{OUT} = 0.5 A; T _J = 25 °C I _{OUT} = 0.5 A;		150	185 280	mΩ mΩ
I _S	Supply current	Off-state; V _{CC} = 24 V; T _{CASE} = 25 °C On-state (all channels ON); V _{CC} = 24 V, T _{CASE} = 100 °C			150 12	μA mA
I _{LGND}	Output current at turn-off	V _{CC} = V _{STAT} = V _{IN} = V _{GND} = 24 V V _{OUT} = 0 V			1	mA
I _{L(off)}	Off-state output current	V _{IN} = V _{OUT} = 0 V;	0		5	μA
V _{OUT(off)}	Off-state output voltage	V _{IN} = 0 V, I _{OUT} = 0 A			3	V
t _{d(Vcccon)}	Power-on delay time from V _{CC} rising edge	Figure 7 on page 10		1		ms

Table 4. Switching (V_{CC} = 24 V)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t _{ON}	Turn-on time	R _L = 48 Ω from 80% V _{OUT} (see Figure 6)	-	50	100	μs
t _{OFF}	Turn-off time	R _L = 48 Ω to 10% V _{OUT} (see Figure 6)	-	75	150	μs
dV _{OUT} /dt(on)	Turn-on voltage slope	R _L = 48 Ω from V _{OUT} = 2.4 V to V _{OUT} = 19.2 V (see Figure 6)	-	0.7		V/μs
dV _{OUT} /dt(off)	Turn-off voltage slope	R _L = 48 Ω from V _{OUT} = 21.6 V to V _{OUT} = 2.4 V (see Figure 6)	-	1.5		V/μs

Table 5. Input pin

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{INL}	Input low level				$V_{CC}/2-1$	V
I_{INL}	Low level input current	$V_{IN} = V_{CC} / 2 - 1$ V	80		650	μ A
V_{INH}	Input high level		$V_{CC}/2+1$			V
I_{INH}	High level input current	$V_{IN} = V_{CC} / 2 + 1$ V		150	260	μ A
$V_{I(HYST)}$	Input hysteresis voltage			0.6		V
I_{IN}	Input current	$V_{IN} = V_{CC} = 32$ V			300	μ A

Table 6. Protection

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{CSD}	Case shutdown temperature		125	130	135	$^{\circ}$ C
T_{CR}	Case reset temperature		110			$^{\circ}$ C
T_{CHYST}	Case thermal hysteresis		7	15		$^{\circ}$ C
T_{TSD}	Junction shutdown temperature		150	175	200	$^{\circ}$ C
T_R	Junction reset temperature		135			$^{\circ}$ C
T_{HYST}	Junction thermal hysteresis		7	15		$^{\circ}$ C
I_{lim}	DC short-circuit current per channel	$V_{CC} = 24$ V; $R_{LOAD} = 10$ m Ω	0.7		1.7	A
V_{demag}	Turn-off output clamp voltage	$I_{OUT} = 0.5$ A; $L = 6$ mH	$V_{CC}-57$	$V_{CC}-52$	$V_{CC}-47$	V

Table 7. Status pin

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{HSTAT}	High level output current	$V_{CC} = 18...32$ V; $R_{STAT} = 1$ k Ω (Fault condition)	2	3	4	mA
I_{LSTAT}	Leakage current	Normal operation; $V_{CC} = 32$ V			0.1	μ A
V_{CLSTAT}	Clamp voltage	$I_{STAT} = 1$ mA $I_{STAT} = -1$ mA	6.0	6.8 -0.7	8.0	V V

3 Pin connections

Figure 2. Connection diagram (top view)

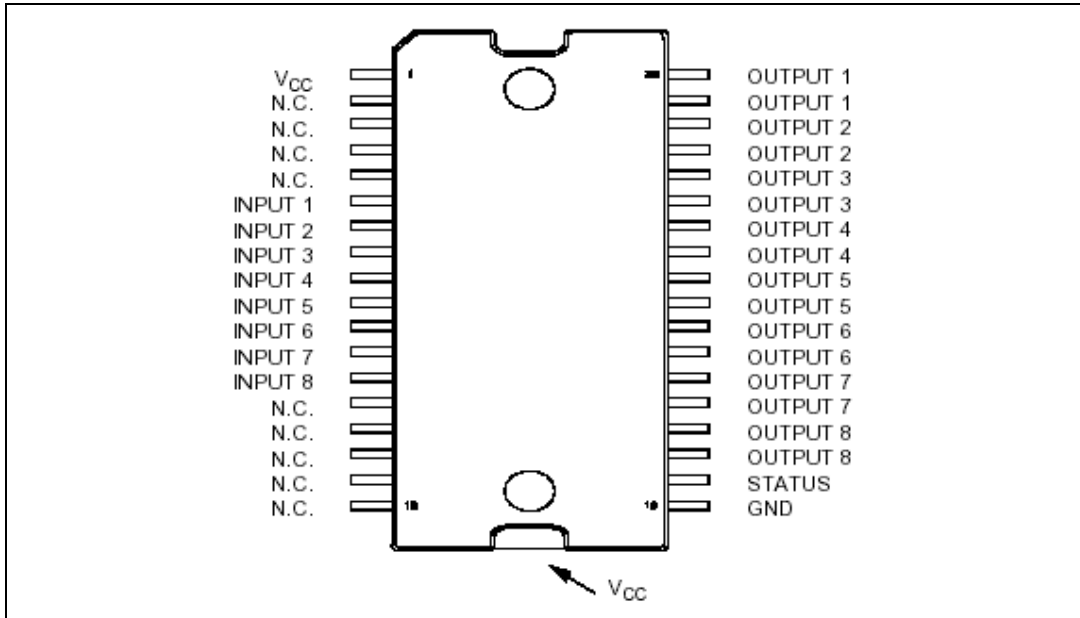


Table 8. Pin functions

Pin	Symbol	Function
TAB	V _{CC}	Positive power supply voltage
1	V _{CC}	Positive power supply voltage
2,3,4,5	NC	Not connected
6	Input 1	Input of channel 1
7	Input 2	Input of channel 2
8	Input 3	Input of channel 3
9	Input 4	Input of channel 4
10	Input 5	Input of channel 5
11	Input 6	Input of channel 6
12	Input 7	Input of channel 7
13	Input 8	Input of channel 8
14,15,16,17,18	NC	Not connected
19	GND	Logic ground
20	STATUS	Common open source diagnostic for overtemperature
21,22	Output 8	High-side output of channel 8
23,24	Output 7	High-side output of channel 7
25, 26	Output 6	High-side output of channel 6

Table 8. Pin functions (continued)

Pin	Symbol	Function
27, 28	Output 5	High-side output of channel 5
29, 30	Output 4	High-side output of channel 4
31, 32	Output 3	High-side output of channel 3
33, 34	Output 2	High-side output of channel 2
35, 36	Output 1	High-side output of channel 1

4 Current, voltage conventions and internal diagram

Figure 3. Current and voltage conventions

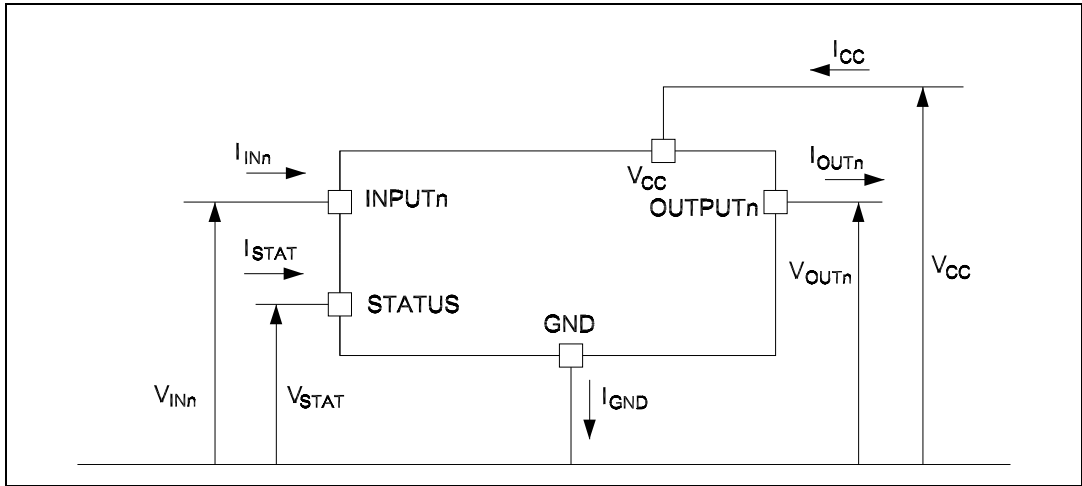


Figure 4. Equivalent internal block diagram (same structure for all channels)

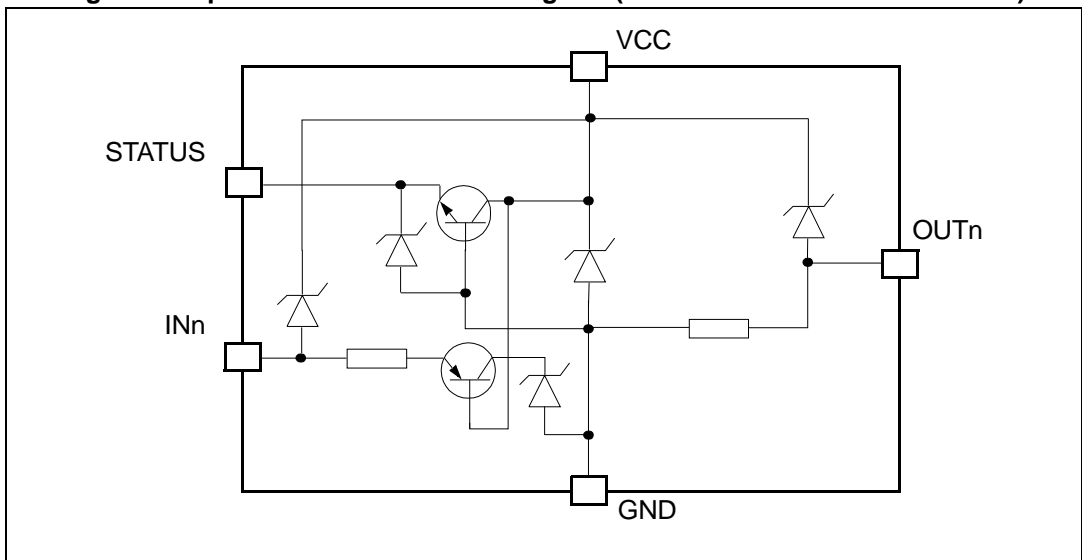
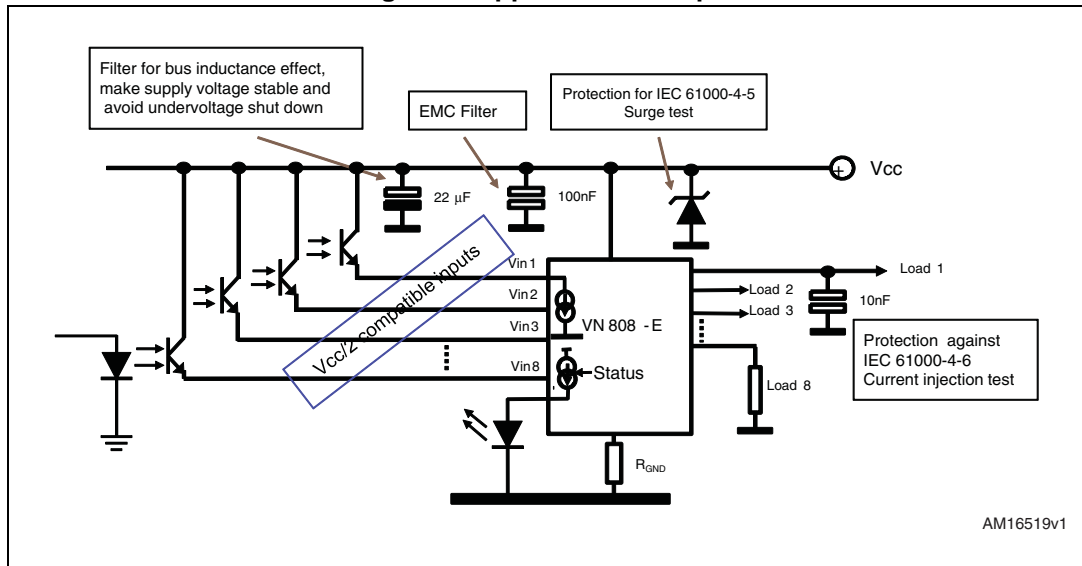


Figure 5. Application example



AM16519v1

Table 9. Truth table

Conditions	INPUTn	OUTPUTn	STATUS
Normal operation	L	L	L
	H	H	L
Current limitation	L	L	L
	H	X	L
Overtemperature (see waveforms 3, 4 Figure 8) -> $T_J > T_{TSD}$	L	L	L
	H	L	H
Undervoltage	L	L	X
	H	L	X

5 Switching time waveforms

Figure 6. Turn-ON and turn-OFF

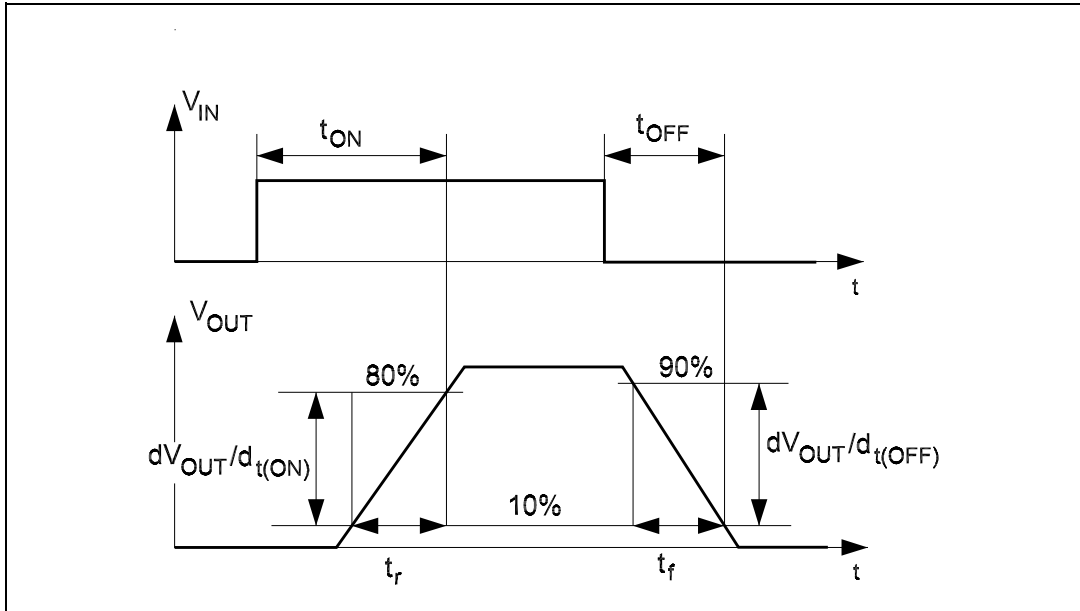


Figure 7. V_{CC} turn-ON

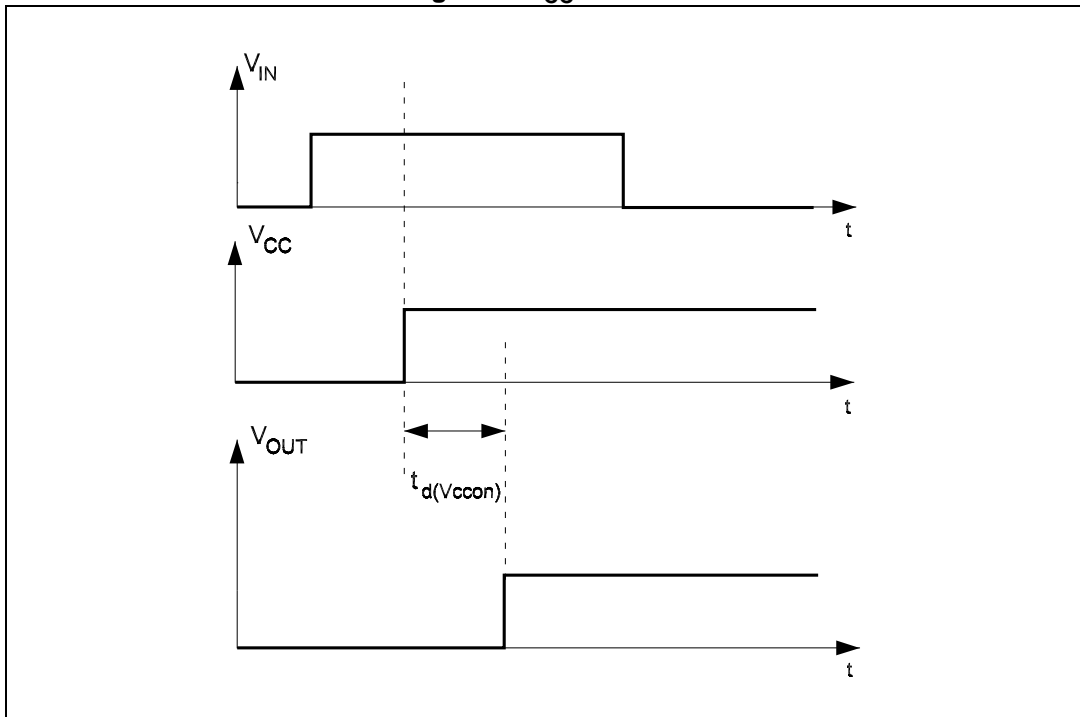


Figure 8. Waveforms

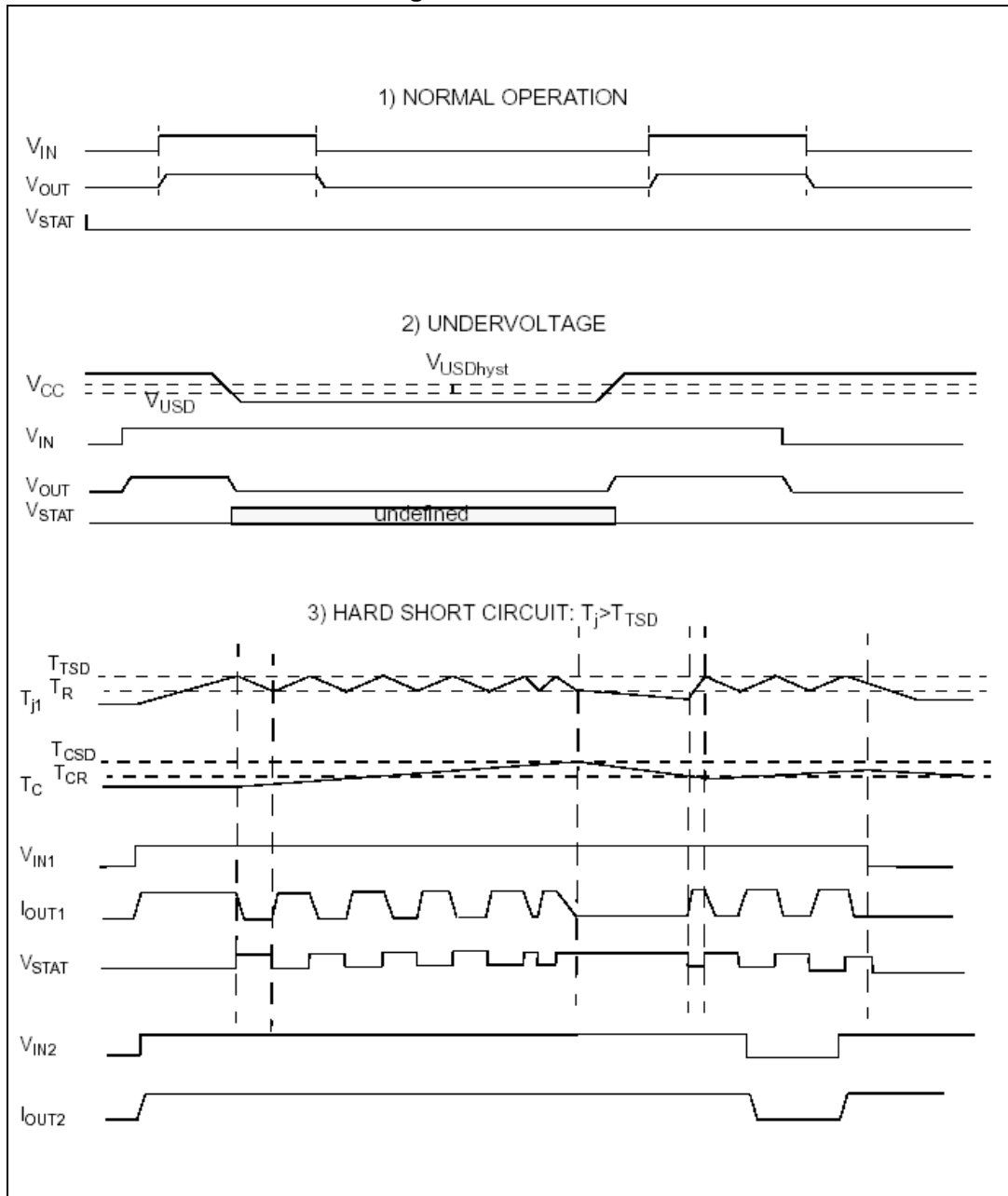
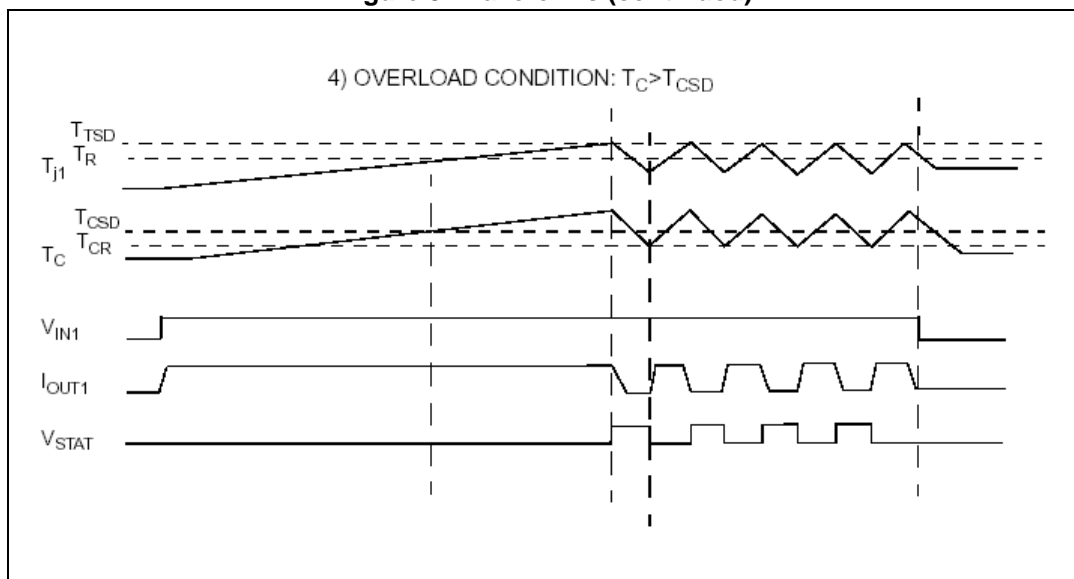


Figure 9. Waveforms (continued)



6 Reverse polarity protection

This schematic can be used with any type of load.

The following is an indication on how to dimension the R_{GND} resistor.

$$R_{GND} = (-V_{CC}) / (-I_{GND})$$

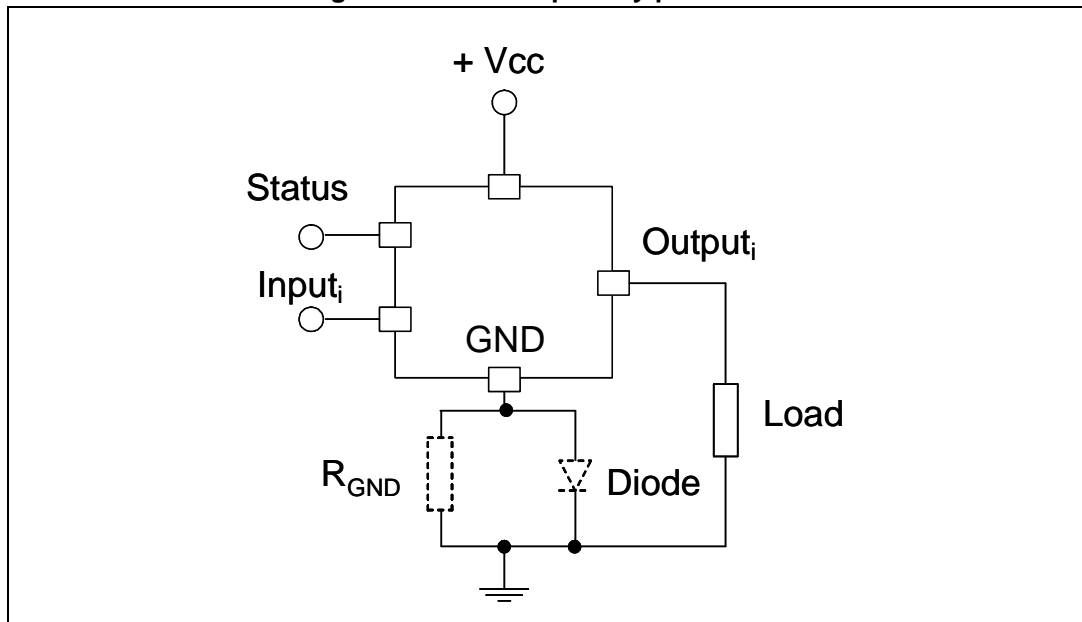
where $-I_{GND}$ is the DC reverse ground current and it can be found in [Section 1: Maximum ratings](#) of this datasheet.

Power dissipation in R_{GND} (when $V_{CC} < 0$: during reverse polarity situations) is:

$$PD = (-V_{CC})^2 / R_{GND}$$

Note: In normal condition (no reverse polarity) due to the diode, there is a voltage drop between GND of the device and GND of the system.

Figure 10. Reverse polarity protection



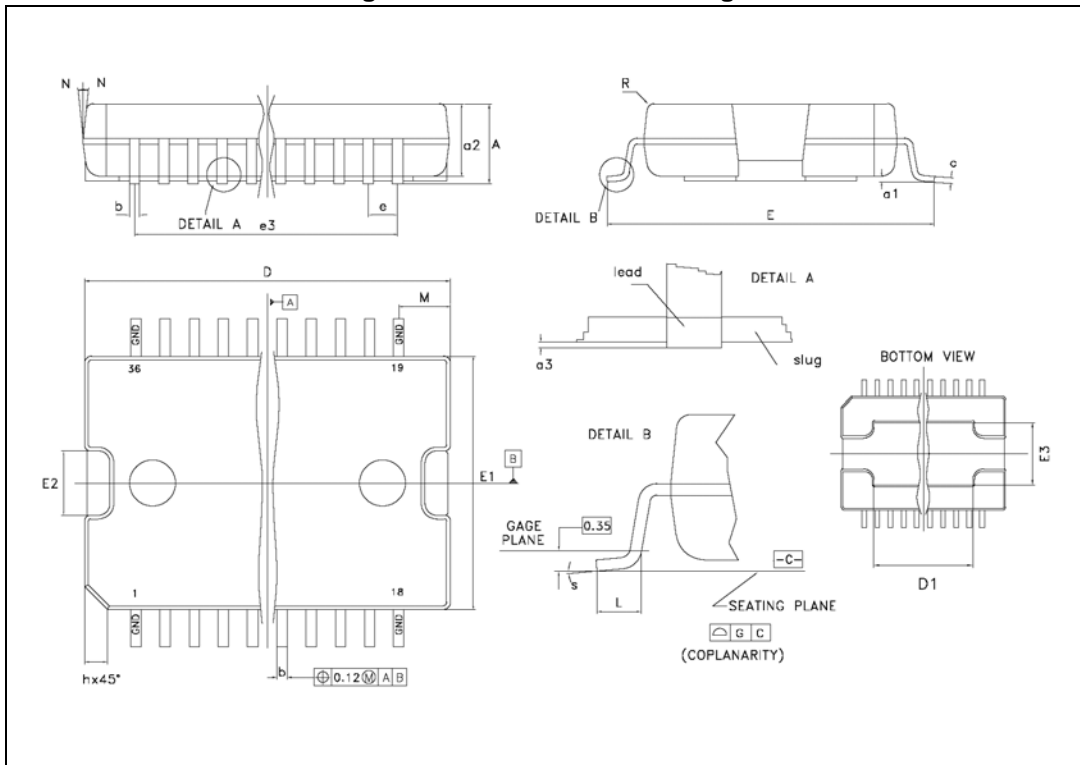
7 Package mechanical data

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 10. PowerSO-36 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			3.60
a1	0.10		0.30
a2			3.30
a3	0		0.10
b	0.22		0.38
c	0.23		0.32
D (1)	15.80		16.00
D1	9.40		9.80
E	13.90		14.50
E1 (1)	10.90		11.10
E2			2.90
E3	5.8		6.2
e		0.65	
e3		11.05	
G	0		0.10
H	15.50		15.90
h			1.10
L	0.80		1.10
N			10°
S	0°		8°

Figure 11. PowerSO-36 drawings



7.1 Footprint recommended data

Figure 12. Footprint recommended data

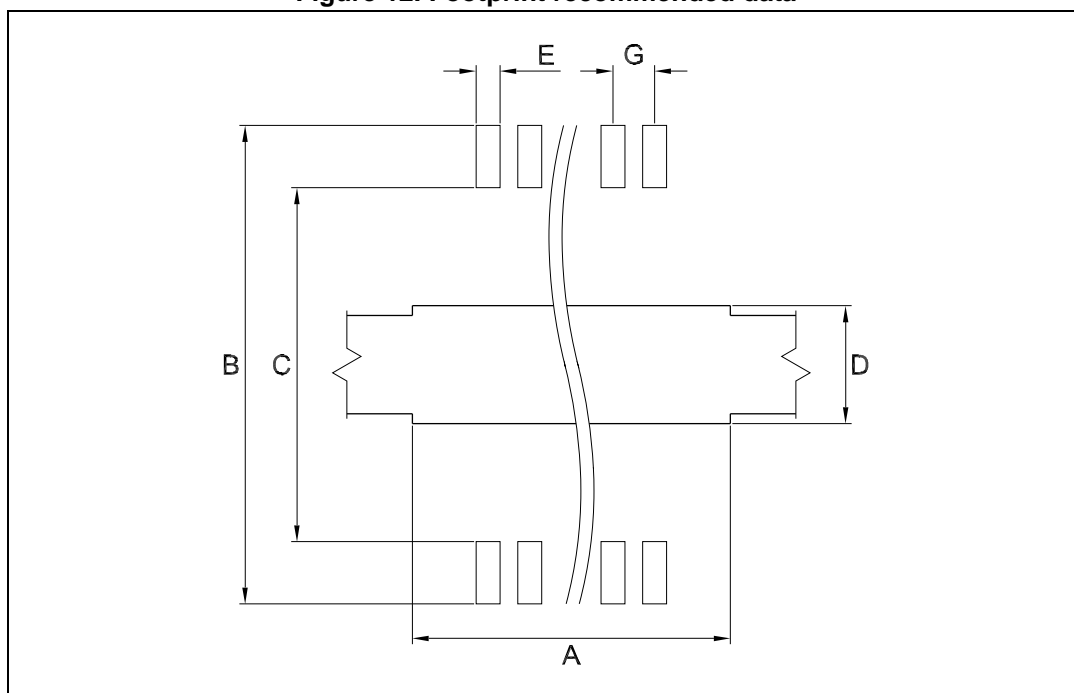


Table 11. Footprint data

Dim.	mm
A	9.5
B	14.7-15.0
C	12.5-12.7
D	6.3
E	0.42
G	0.65

7.2 Tube shipment information

Figure 13. Tube shipment information

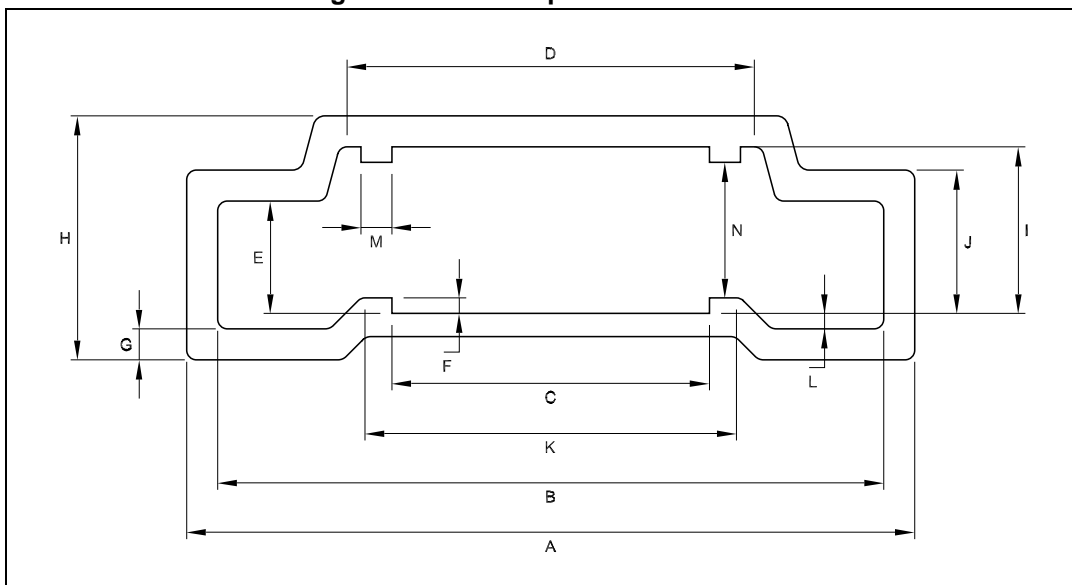


Table 12. Tube mechanical data

Dim.	mm
A	18.80
B	17.2 ±0.2
C	8.20 ±0.2
D	10.90 ±0.2
E	2.90 ±0.2
F	0.40
G	0.80
H	6.30
I	4.30 ±0.2
J	3.7 ±0.2
K	9.4
L	0.40
M	0.80
N	3.50 ±0.2

Base quantity 31 pcs

Bulk quantity 310 pcs

7.3 Tape and reel shipment information

Figure 14. Tape specifications

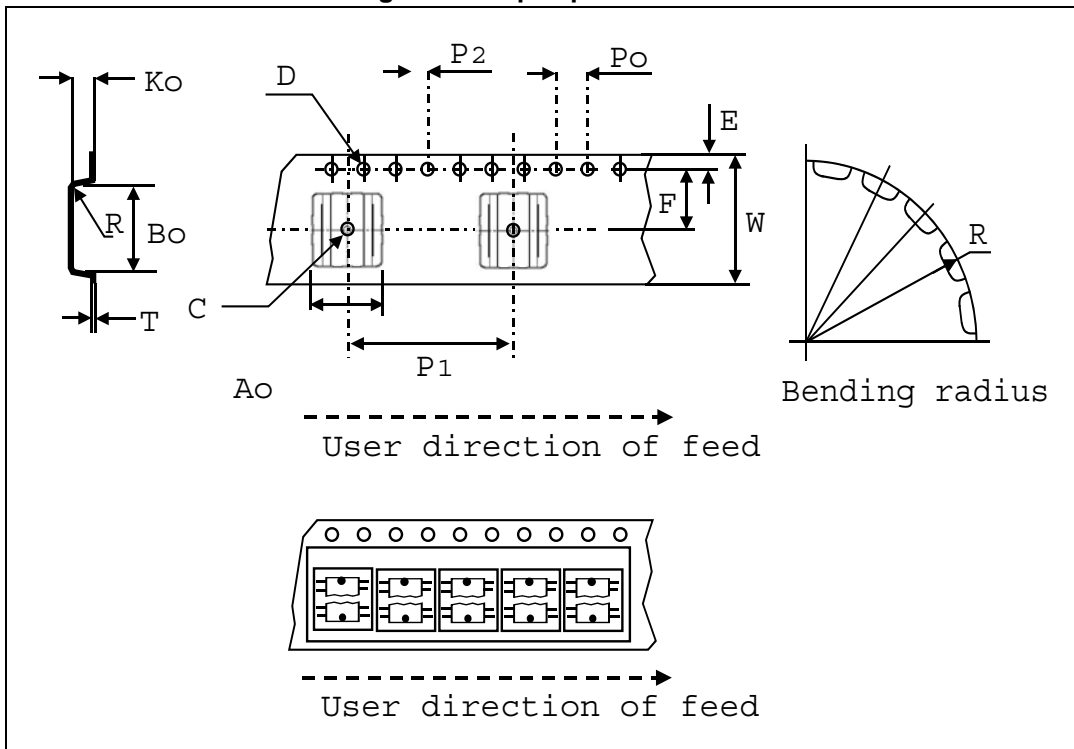


Table 13. Tape mechanical data

Dim.	mm
D	1.50 +0.1/0
E	1.75 ±0.1
Po	4.00 ±0.1
T max.	0.40
D1 min.	1.50
F	11.5 ±0.05
K max.	6.50
P2	2.00 ±0.1
R	50
W	24.00 ±0.30
P1	24.00
Ao, Bo, Ko	0.05 min. to 1.0 max.

Base quantity 600 pcs

Bulk quantity 600 pcs

Figure 15. Reel specifications

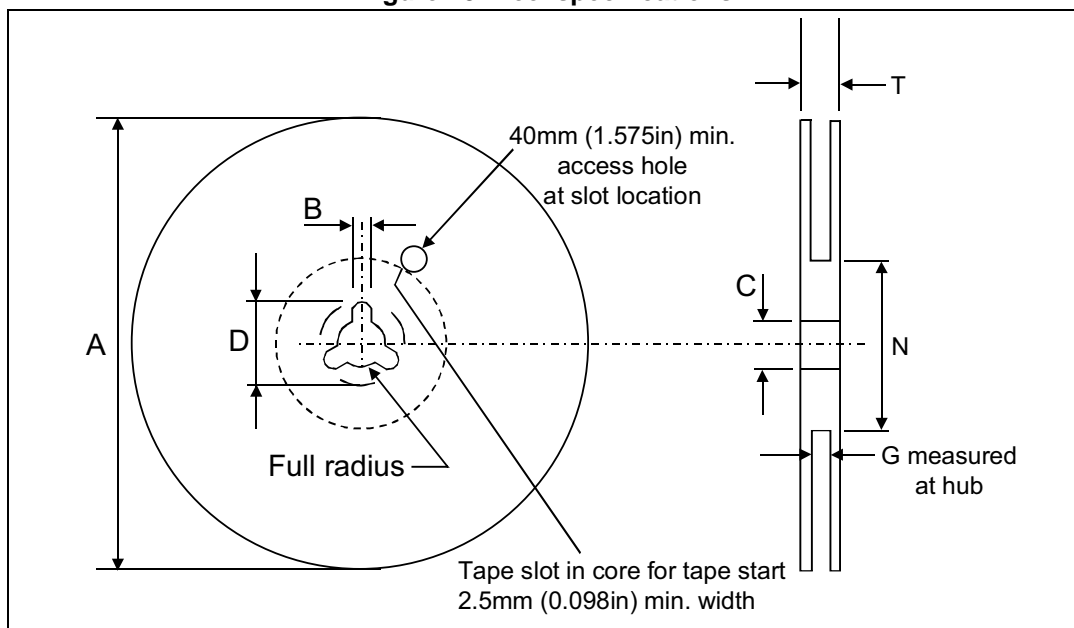


Table 14. Reel mechanical data

Dim.	mm
Tape size	24.0 ±0.30
A max.	330.0
B min.	1.5
C	13.0 ±0.20
D min.	20.2
N min.	60
G	24.4 +2/-0
T max.	30.4

8 Ordering information

Table 15. Order code

Order code	Package	Packaging
VN808-E	PowerSO-36	Tube
VN808TR-E	PowerSO-36	Tape and reel

9 Revision history

Table 16. Document revision history

Date	Revision	Changes
13-Sep-2005	1	Initial release
1-Mar-2007	2	Document reformatted
12-Mar-2007	3	Typo in Figure 3 .
26-Mar-2007	4	Typo note Table 2 .
07-Jul-2008	5	Added: Section 6 on page 13
04-Aug-2008	6	Added: Figure 12: Footprint recommended data on page 16
25-Aug-2009	7	Updated Section 6: Reverse polarity protection
24-Feb-2010	8	Updated Section 7: Package mechanical data
08-Nov-2012	9	Changed Figure 5 . Minor text changes to improve the readability.
19-Nov-2012	10	Added maximum value to I_{INL} parameter in Table 5 .
31-Jul-2013	11	Updated Section 7.1: Footprint recommended data .

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.

ST PRODUCTS ARE NOT AUTHORIZED FOR USE IN WEAPONS. NOR ARE ST PRODUCTS DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

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.

© 2013 STMicroelectronics - All rights reserved

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