

## Octal channel high side driver

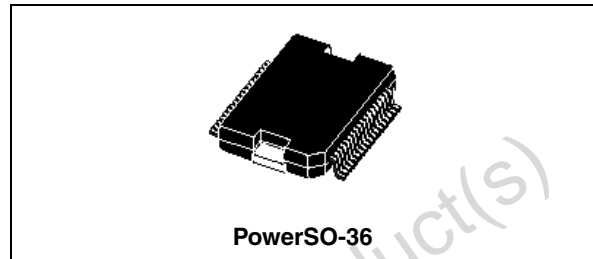
### Features

Type	$R_{DS(on)}$	$I_{out}$	$V_{CC}$
VN808SR	150 m $\Omega$	0.7 A	45 V

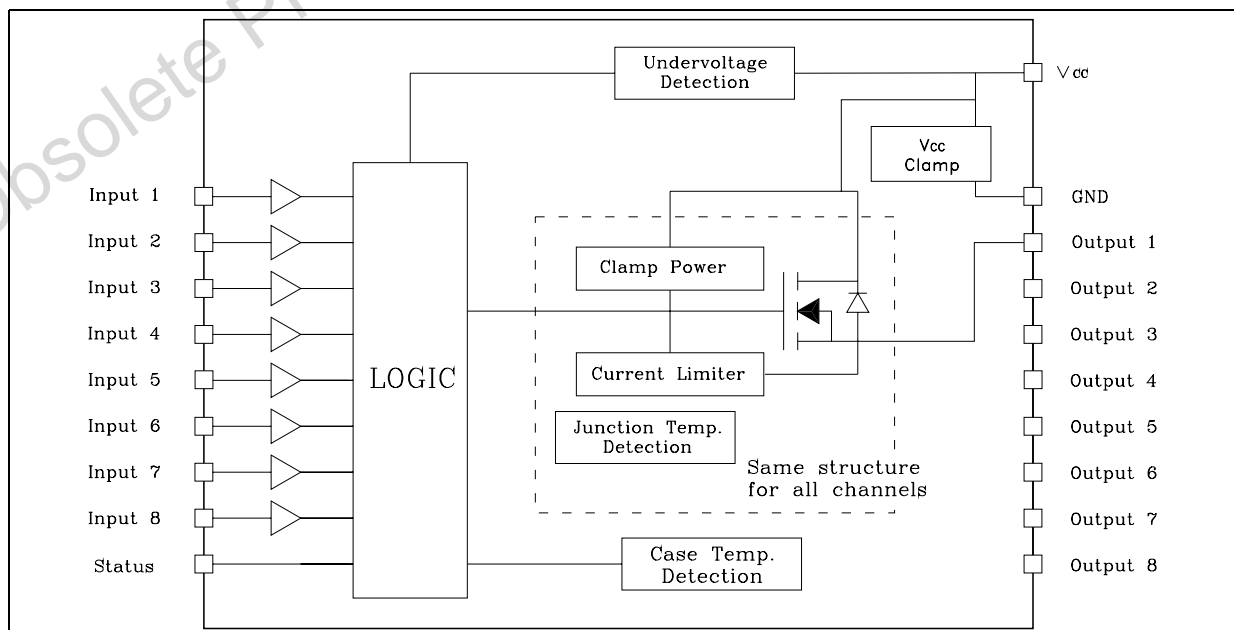
- $V_{CC}/2$  compatible input
- Junction overtemperature protection
- Case overtemperature protection for thermal independence of the channels
- Current limitation
- Shorted load protection
- Undervoltage shut-down
- Protection against loss of ground
- Very low stand-by current
- Compliance to 61000-4-4 IEC test up to 4 kV

### Description

The VN808SR is a monolithic device designed in STMicroelectronics VIPower M0-3 technology, intended for driving 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 condition, the channel turns OFF and back ON automatically so as to maintain the junction temperature between  $T_{TSD}$  and  $T_R$ . If this condition makes the case temperature reach  $T_{CSD}$ , the overloaded channel is turned OFF and restarts only when the case temperature has decreased to  $T_{CR}$  (see waveform 3 [Figure 7 on page 10](#)). Non overloaded channels continue to operate normally. The device automatically turns OFF in the case of a ground pin disconnection. This device is especially suitable for industrial applications and conforms to IEC 61131.



# 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 .....	9
6	Reverse polarity protection .....	12
7	Package mechanical data .....	13
8	Order codes .....	15
9	Revision history .....	16

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# 1 Maximum ratings

**Table 1. Absolute maximum rating**

Symbol	Parameter	Value	Unit
$V_{CC}$	DC supply voltage	45	V
$-I_{GND}$	DC ground pin reverse current TRAN ground pin 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	$\pm 10$	mA
$V_{IN}$	Input voltage range	$-3/+V_{CC}$	V
$V_{ESD}$	Electrostatic discharge (R = 1.5 k $\Omega$ , 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
$R_{thJC}$	Thermal resistance junction-case	Max 1.3	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance junction-ambient <sup>(1)</sup>	Max 50	$^\circ\text{C}/\text{W}$

1. When mounted on FR4 printed circuit board with 0.5 cm<sup>2</sup> of copper area (at least 35  $\mu\text{m}$  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
$t_d(V_{CCon})$	Power-on delay time from $V_{CC}$ rising edge	<a href="#">Table 7.</a>		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% $V_{OUT}$ <a href="#">Figure 5.</a>		50	100	μs
$t_{OFF}$	Turn-off time	$R_L = 48$ Ω to 10% $V_{OUT}$ <a href="#">Figure 5.</a>		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 <a href="#">Figure 5.</a>		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 <a href="#">Figure 5.</a>		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	$V_{IN} = V_{CC} / 2 - 1 \text{ V}$	80			$\mu\text{A}$
$V_{INH}$	Input high level		$V_{CC}/2+1$			V
$I_{INH}$	High level input current	$V_{IN} = V_{CC} / 2 + 1 \text{ V}$		150	260	$\mu\text{A}$
$V_{I(HYST)}$	Input hysteresis voltage			0.6		V
$I_{IN}$	Input current	$V_{IN} = V_{CC} = 32 \text{ V}$			300	$\mu\text{A}$

**Table 6. Protections**

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

**Table 7. Status pin**

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

### 3 Pin connections

Figure 2. Connection diagram (top view)

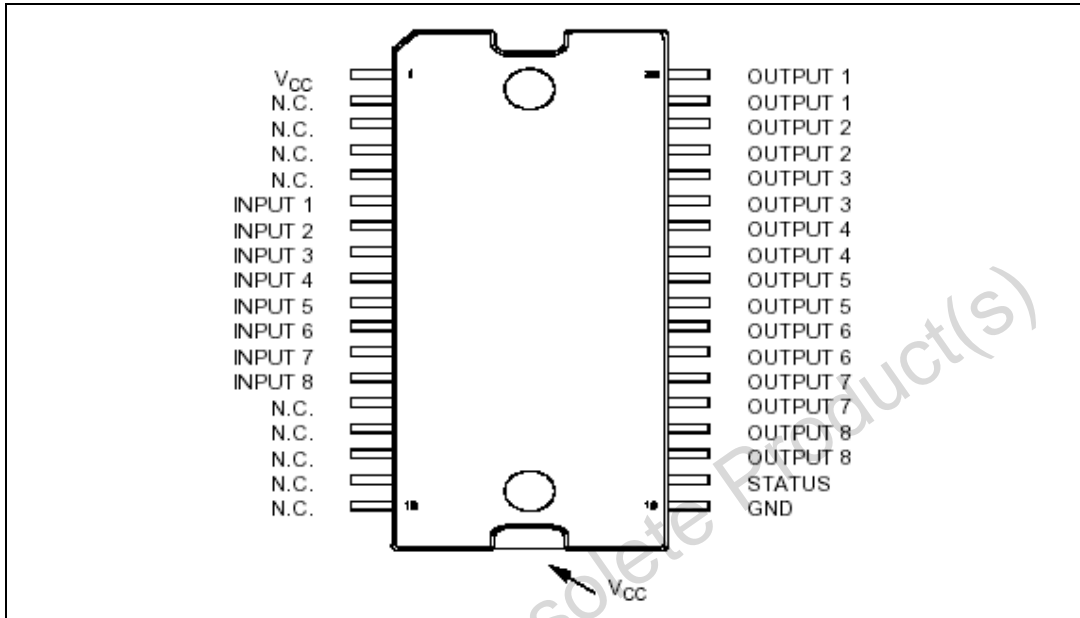


Table 8. Pin functions

Pin N°	Symbol	Function
TAB	V <sub>CC</sub>	Positive power supply voltage
1	V <sub>CC</sub>	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 over-temperature
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 N°	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

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## 4 Current, voltage conventions and internal diagram

Figure 3. Current and voltage conventions

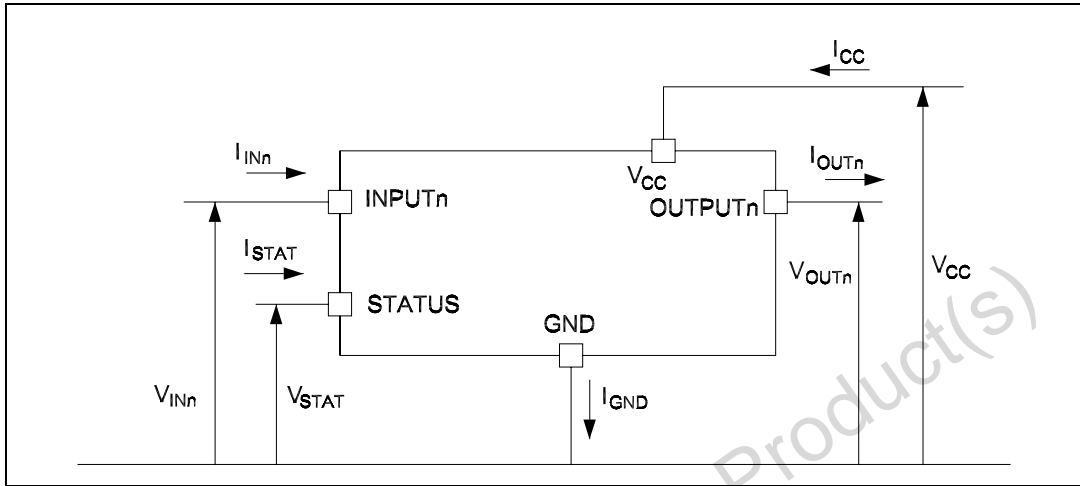


Figure 4. Equivalent internal block diagram (same structure for all channel)

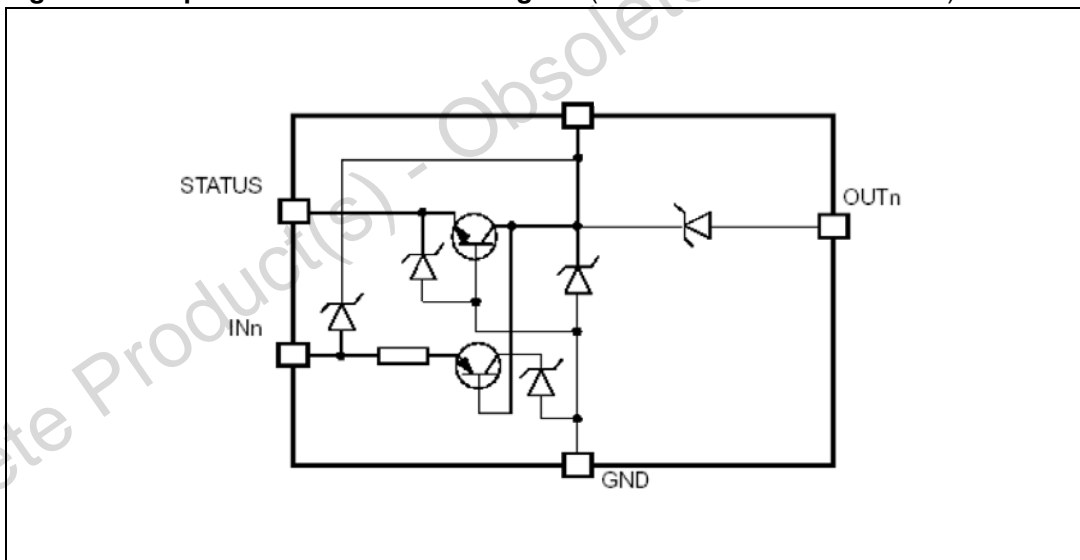


Table 9. Truth table

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 <a href="#">Figure 7</a> ) -> $T_J > T_{TSD}$	L	L	L
	H	L	H
Undervoltage	L	L	X
	H	L	X



## 5 Switching time waveforms

Figure 5. Turn-ON and turn-OFF

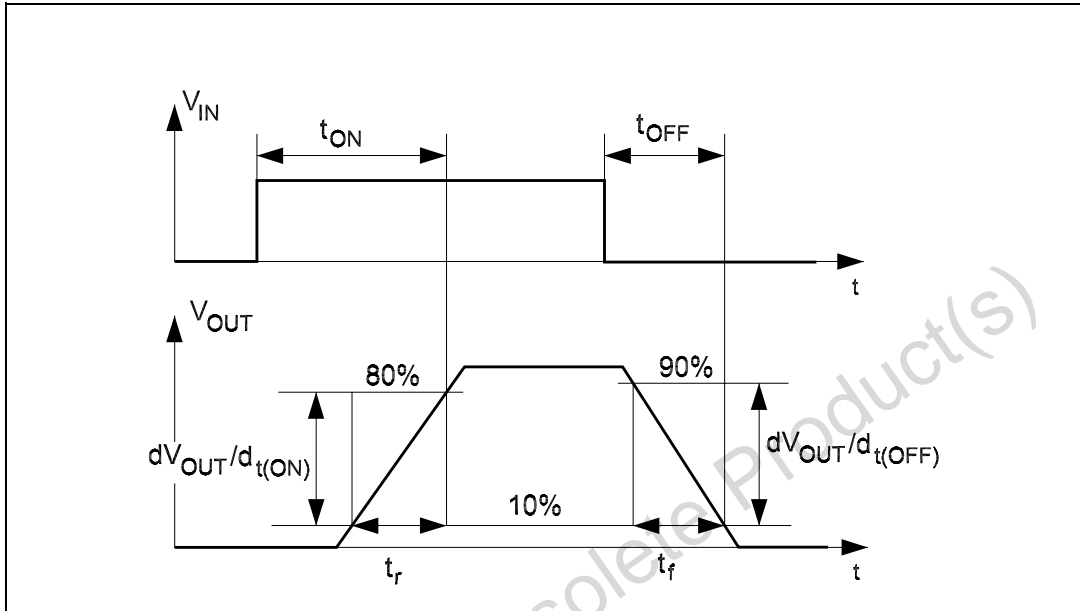


Figure 6.  $V_{CC}$  turn-ON

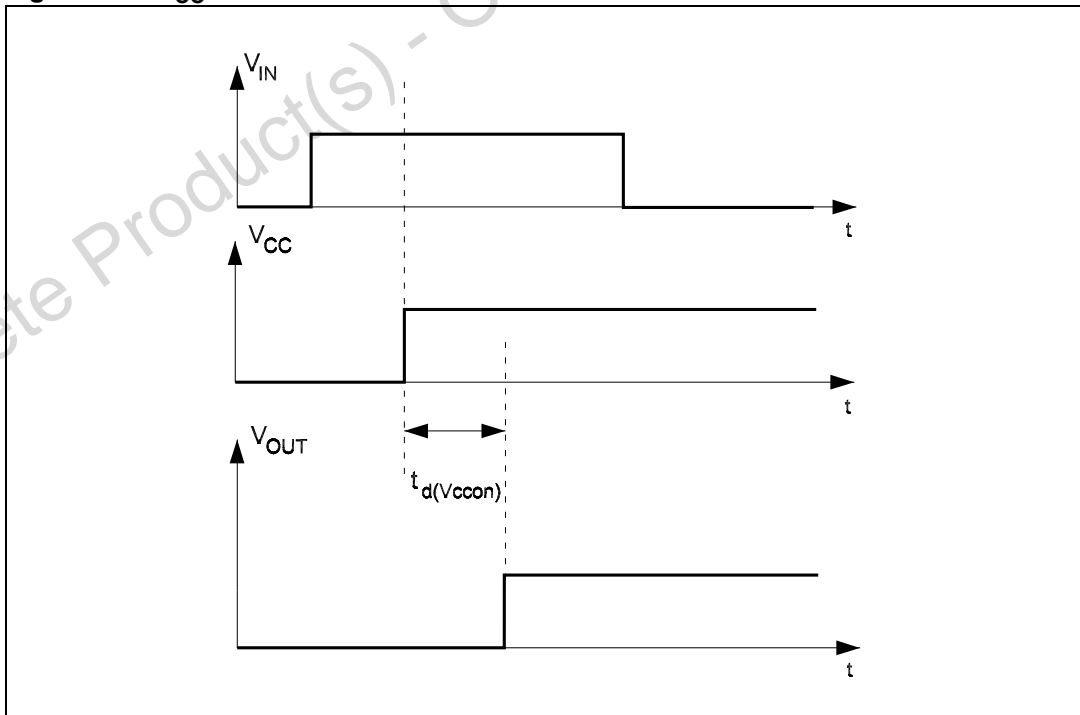


Figure 7. Waveforms

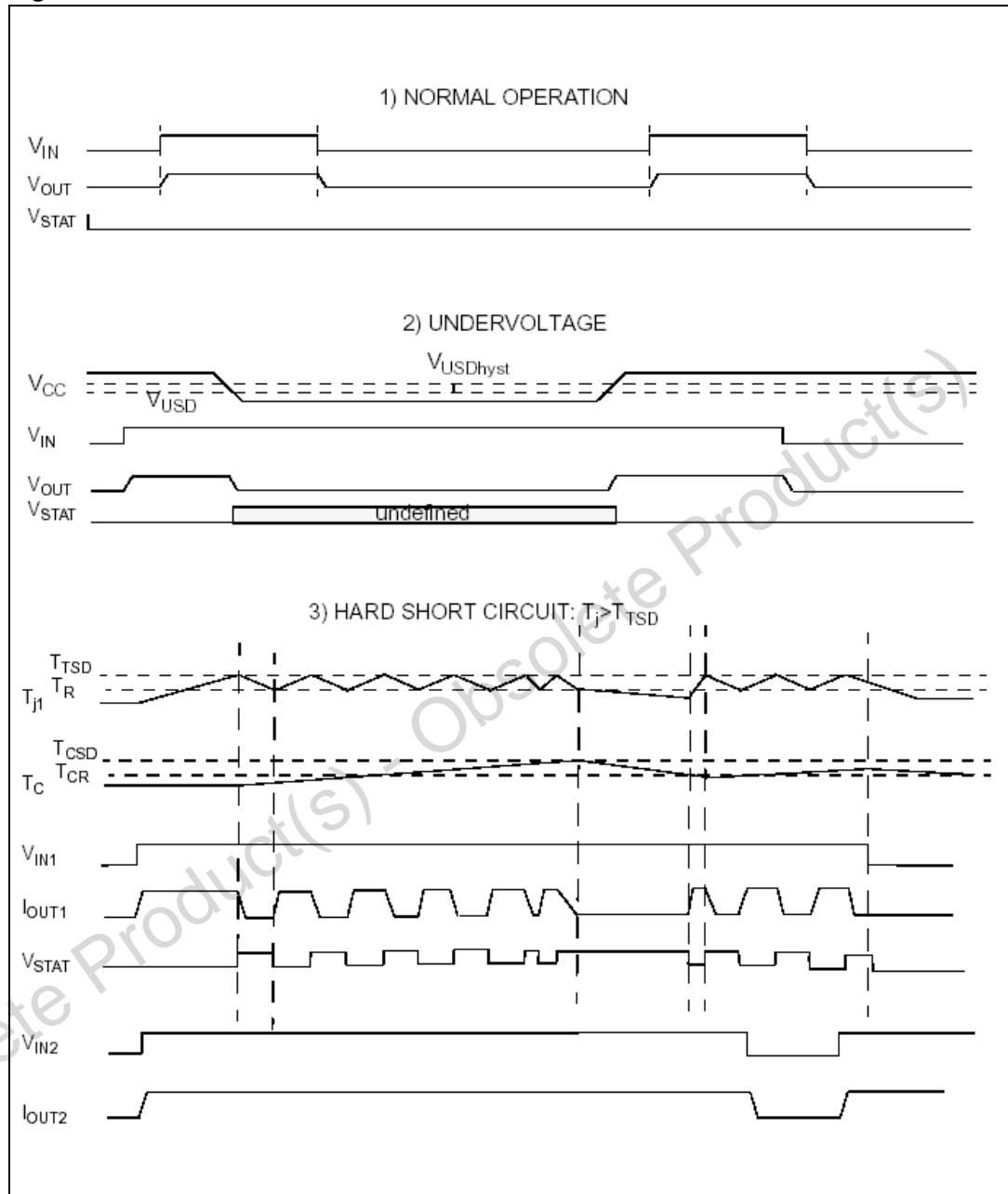
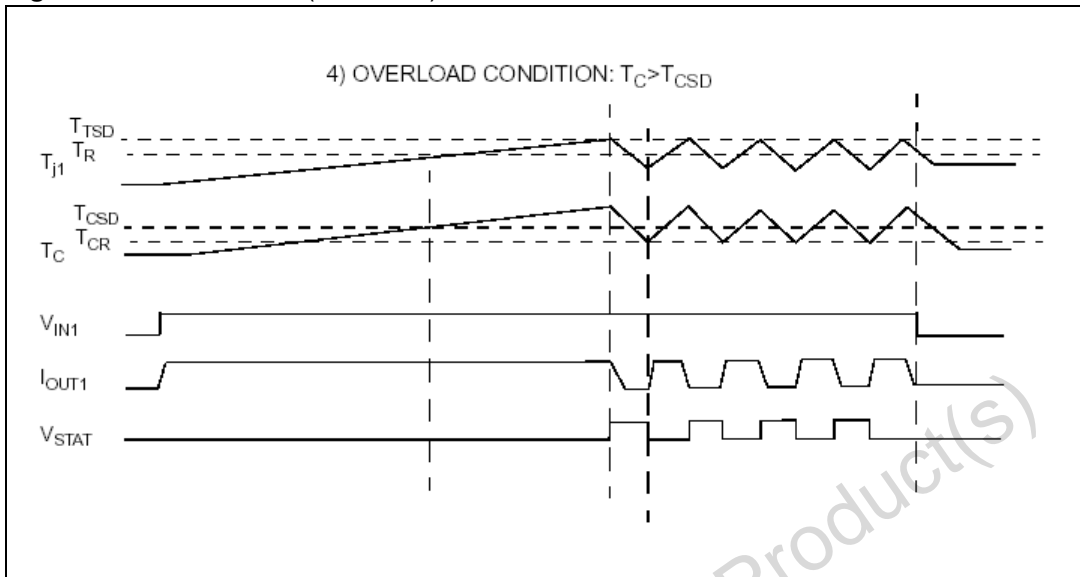


Figure 7. Waveforms (continued)



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## 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.

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

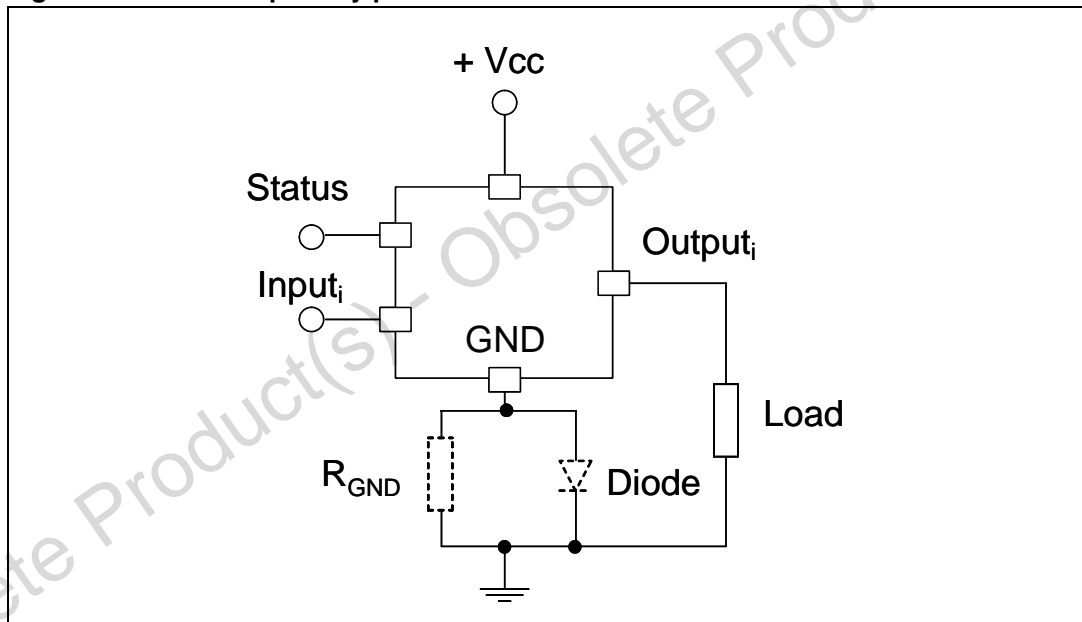
where  $-I_{GND}$  is the DC reverse ground pin current and can be found in the absolute maximum rating section of the device datasheet.

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 will be a voltage drop between GND of the device and GND of the system.

**Figure 8. Reverse polarity protection**



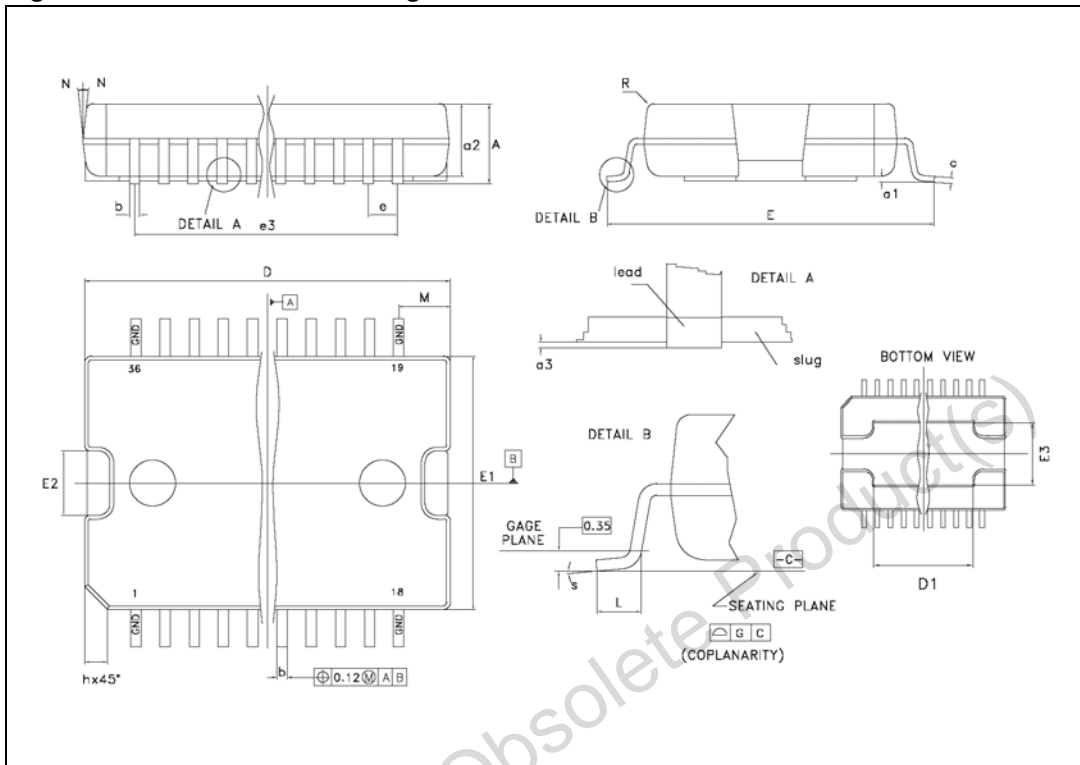
## 7 Package mechanical data

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

**Table 10. PowerSO-36 mechanical data**

Dim.	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A			3.60			0.1417
a1	0.10		0.30	0.003		0.0118
a2			3.30			0.1299
a3	0		0.10	0		0.0039
b	0.22		0.38	0.008		0.0150
c	0.23		0.32	0.009		0.0126
D (1)	15.80		16.00	0.622		0.6299
D1	9.40		9.80	0.370		0.3858
E	13.90		14.50	0.547		0.5709
E1 (1)	10.90		11.10	0.429		0.4370
E2			2.90			0.1142
E3	5.8		6.2	0.228		0.2441
e		0.65			0.025	
e3		11.05			0.435	
G	0		0.10	0.000		0.0039
H	15.50		15.90	0.610		0.6260
h			1.10			0.0433
L	0.80		1.10	0.031		0.0433
N			10°			10°
S	0°		8°	0°		8°

Figure 9. PowerSO-36 drawings



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## 8 Order codes

Table 11. Order codes

Order codes	Package	Packaging
VN808SR	PowerSO-36	Tube
VN808SR13TR	PowerSO-36	Tape and reel

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## 9 Revision history

Table 12. Document revision history

Date	Revision	Changes
13-Sep-2005	1	Initial release
01-Mar-2007	2	Document reformatted
26-Mar-2007	3	Typo in <i>Figure 3</i> .
07-Jul-2008	4	Added <i>Section 4 on page 8</i>
25-Aug-2009	5	Updated <i>Section 6: Reverse polarity protection</i>

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