

Octal channel high side driver

Features

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

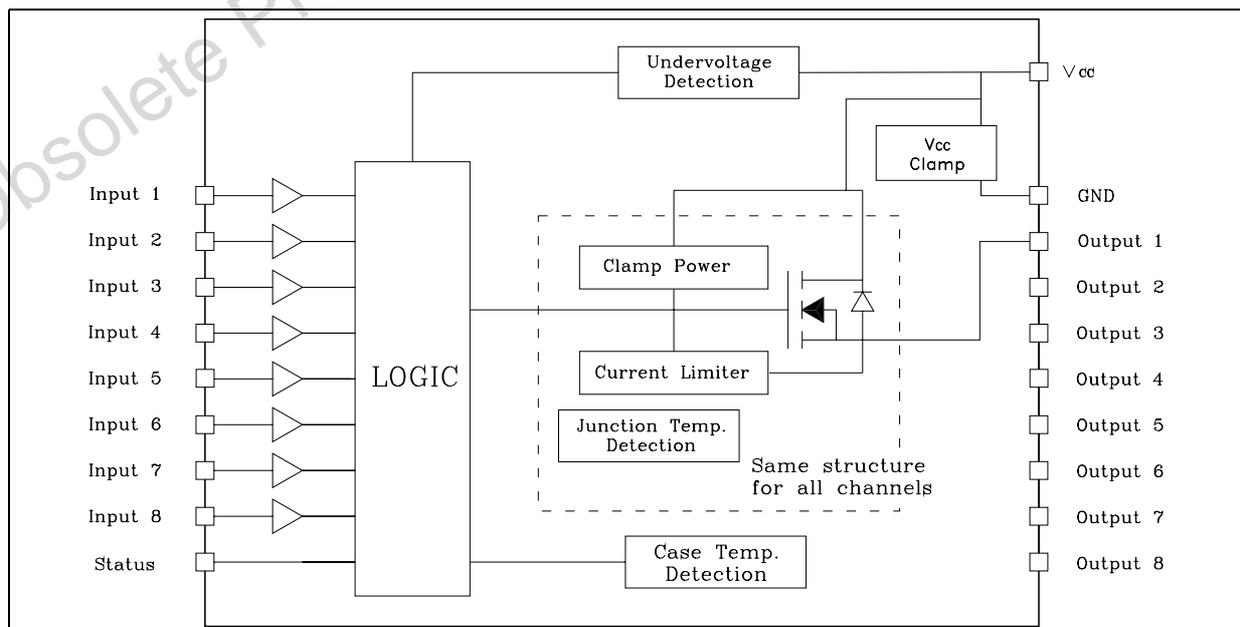
- $V_{CC}/2$ compatible input
- Junction overtemperature protection
- Case overtemperature protection for thermal independence of the channels
- Current limitation
- Shorted load protection
- Undervoltage shut-down
- Protection against loss of ground
- Very low stand-by current
- Compliance to 61000-4-4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



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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 | ± 10 | mA |
| V_{IN} | Input voltage range | $-3/+V_{CC}$ | V |
| V_{ESD} | Electrostatic discharge ($R = 1.5\text{ k}\Omega$, $C = 100\text{ pF}$) | 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 ⁽¹⁾ | Max 50 | $^\circ\text{C}/\text{W}$ |

1. When mounted on FR4 printed circuit board with 0.5 cm^2 of copper area (at least $35\text{ }\mu\text{m}$ 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(Vcon)} | Power-on delay time from V _{CC} rising edge | Table 7. | | 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} Figure 5. | | 50 | 100 | μs |
| t _{OFF} | Turn-off time | R _L = 48 Ω to 10% V _{OUT} Figure 5. | | 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 Figure 5. | | 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 Figure 5. | | 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 | | | μA |
| 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 | μA |
| $V_{I(HYST)}$ | Input hysteresis voltage | | | 0.6 | | V |
| I_{IN} | Input current | $V_{IN} = V_{CC} = 32 \text{ V}$ | | | 300 | μA |

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 | μA |
| 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)

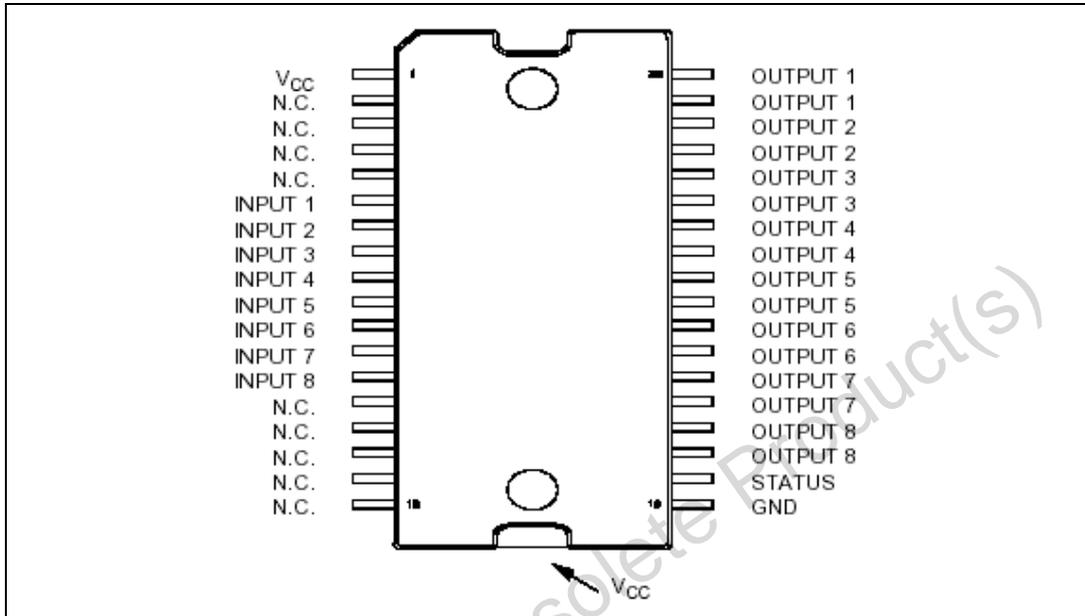


Table 8. Pin functions

| Pin N° | Symbol | Function |
|----------------|-----------------|--|
| TAB | V _{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 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

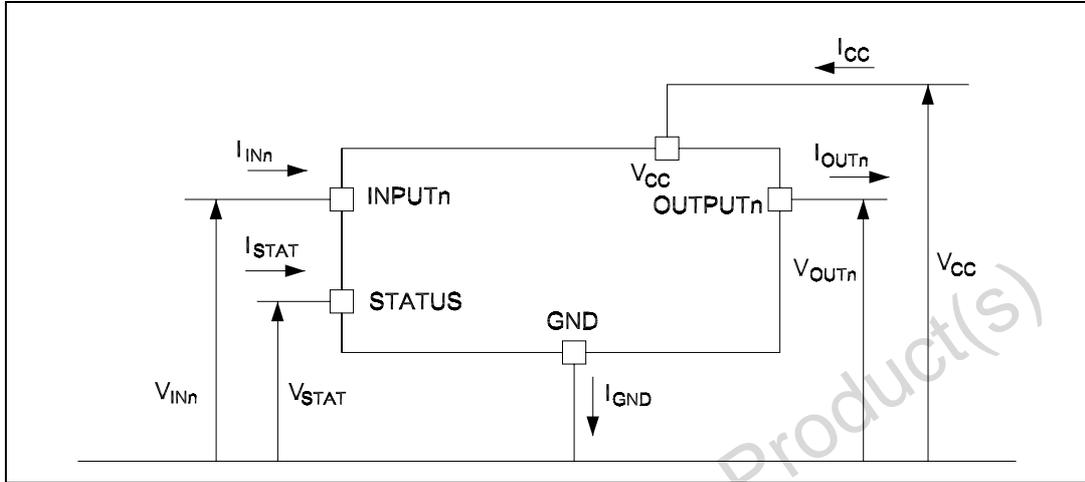


Figure 4. Equivalent internal block diagram (same structure for all channel)

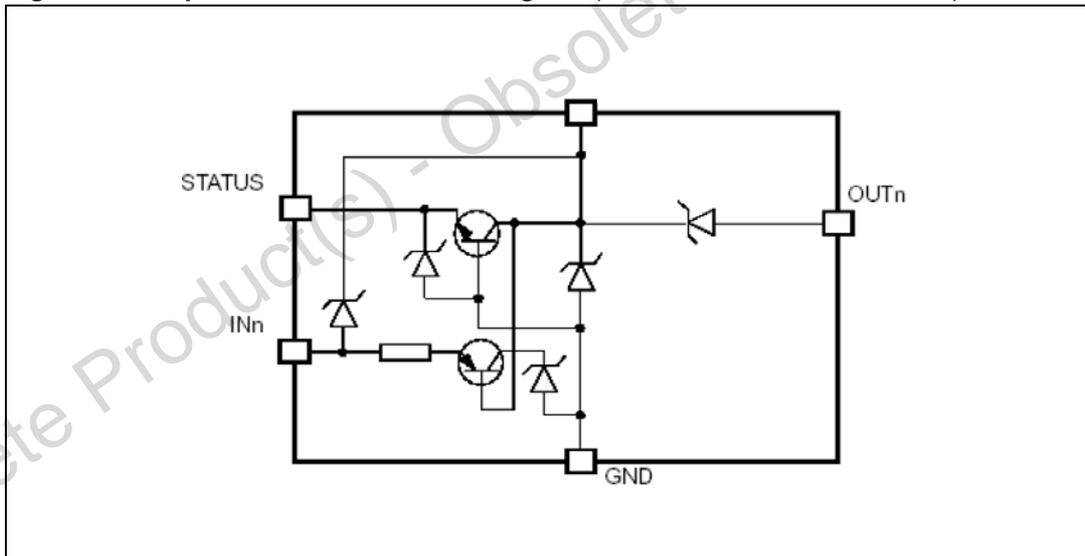


Table 9. Truth table

| 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 Figure 7) -> $T_J > T_{TSD}$ | L | L | L |
| | H | L | H |
| Undervoltage | L | L | X |
| | H | L | X |

5 Switching time waveforms

Figure 5. Turn-ON and turn-OFF

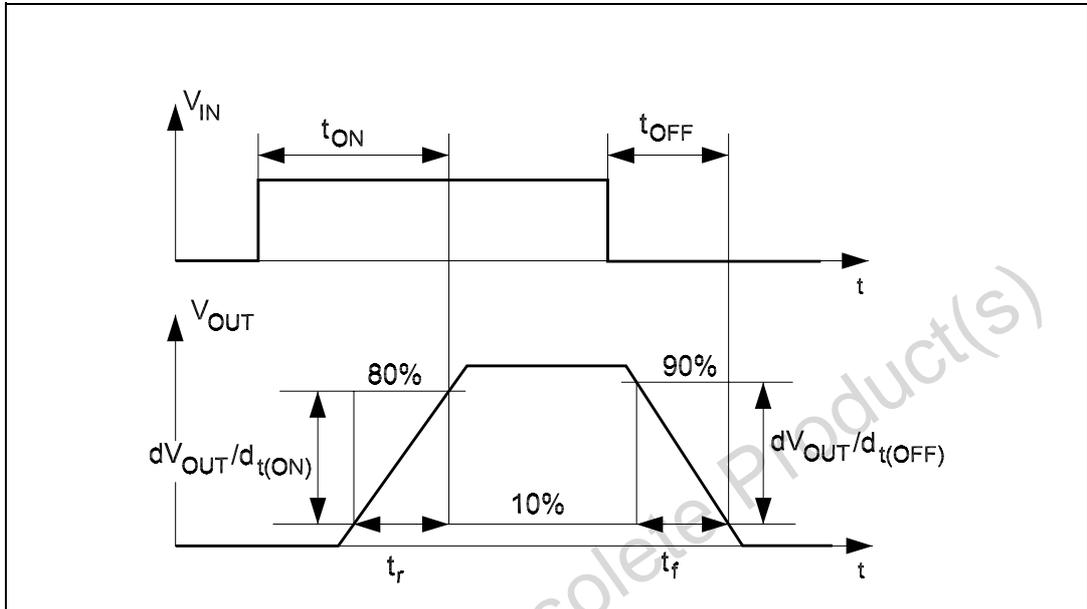


Figure 6. V_{CC} turn-ON

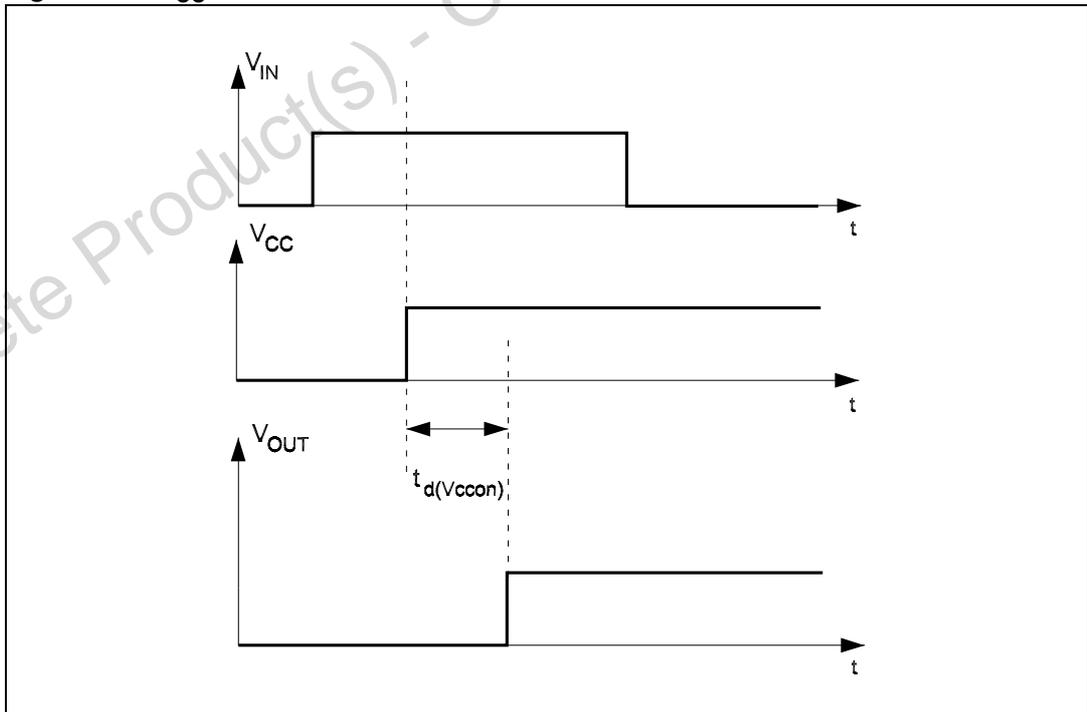


Figure 7. Waveforms

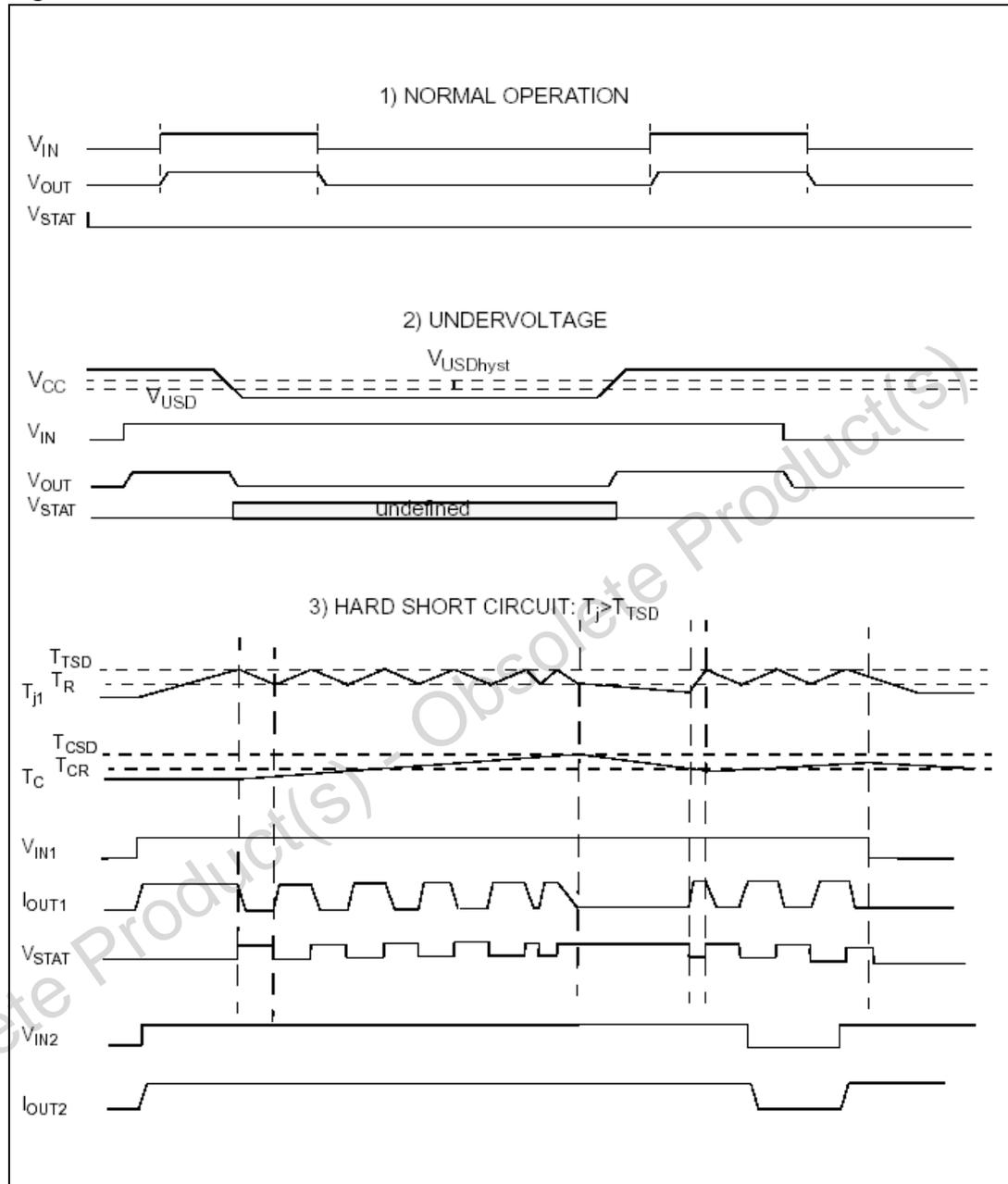
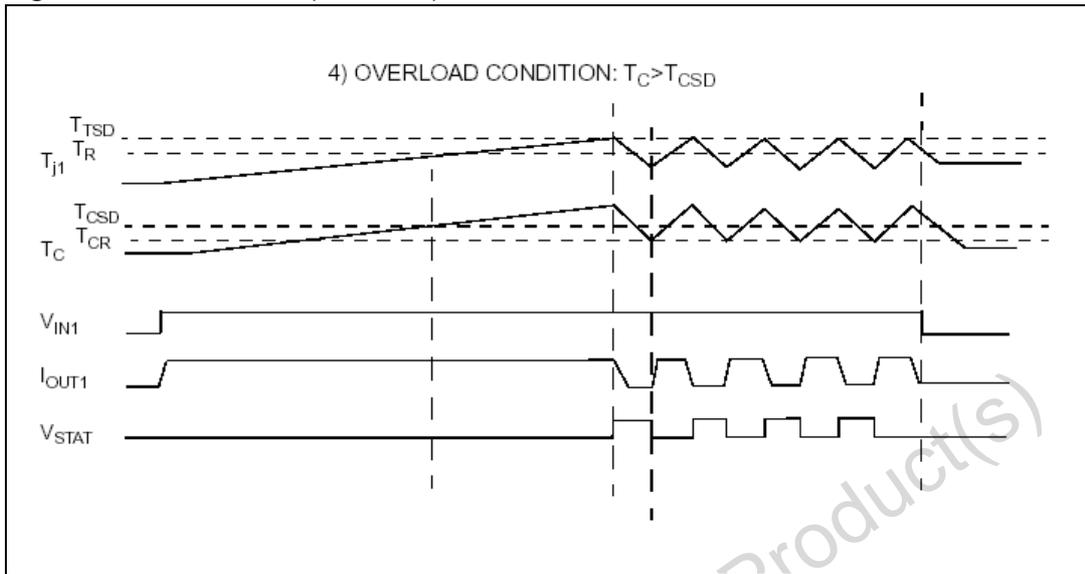


Figure 7. Waveforms (continued)



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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.

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

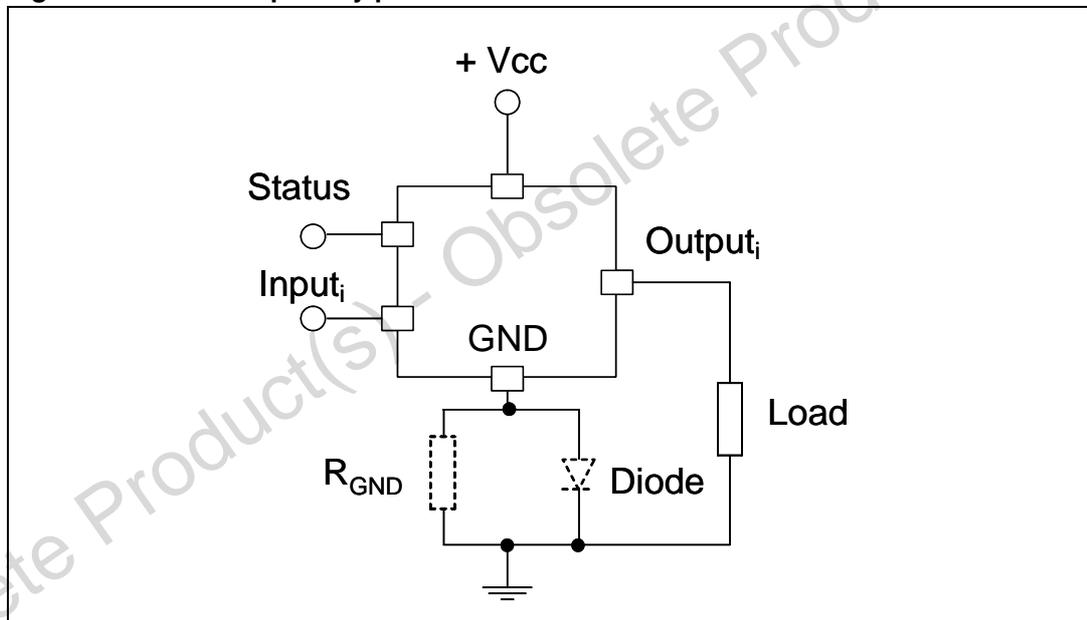
where $-I_{GND}$ is the DC reverse ground pin current and can be found in the absolute maximum rating section of the device datasheet.

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



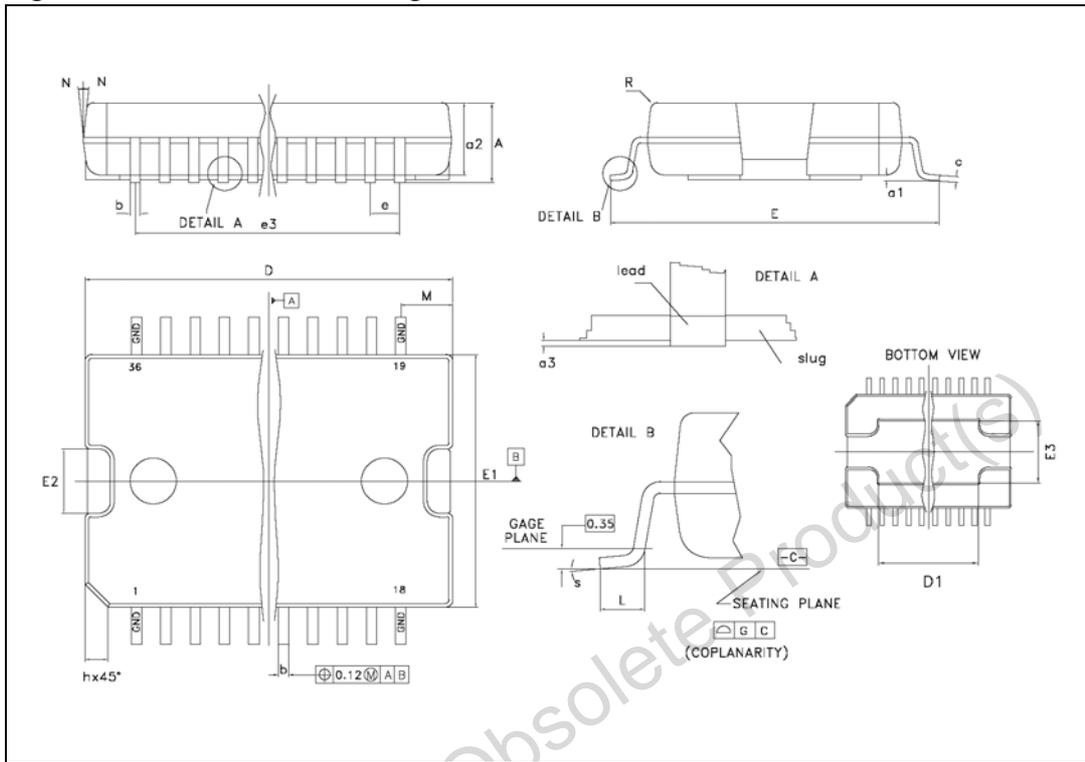
7 Package mechanical data

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. 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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