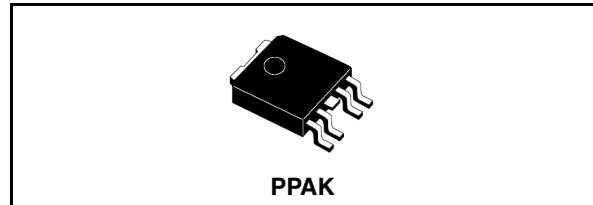


### Features

Type	$R_{DS(on)}$	$I_{out}$	$V_{CC}$
VN751PT	60m $\Omega$	2.5A	36 V

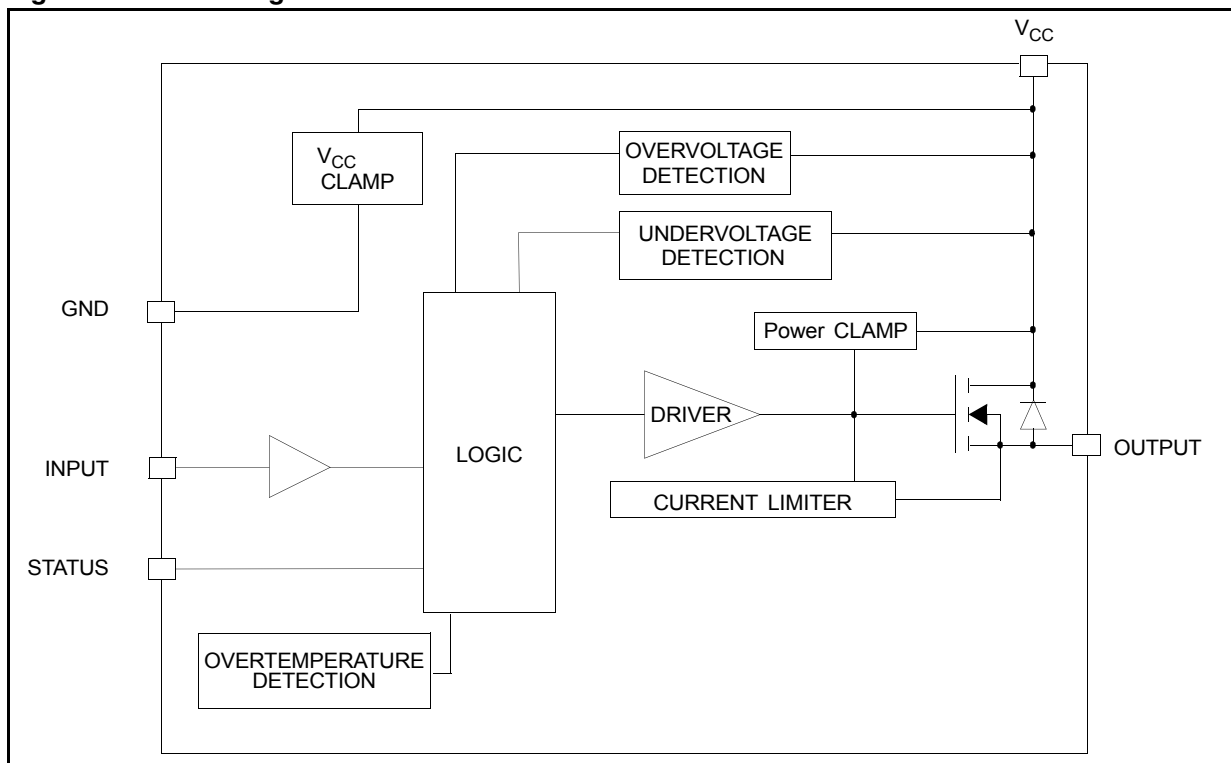
- CMOS compatible input
- Thermal shutdown
- Shorted load protection
- Undervoltage and overvoltage shutdown
- Protection against loss of ground
- Very low stand-by current
- Compliance to 61000-4-4 IEC test up to 4KV



### Description

The VN751PT 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  $V_{CC}$  pin voltage clamp protects the device against low energy spikes. Active current limitation combined with thermal shutdown and automatic restart protect the device against overload. Device automatically turns off in case of ground pin disconnection. This device is especially suitable for industrial applications in norms conformity with IEC 61131-2 (Programmable Controllers International Standard)

**Figure 1. Block diagram**



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# 1 Maximum ratings

**Table 1. Absolute maximum rating**

Symbol	Parameter	Value	Unit
$V_{CC}$	DC supply voltage (Overvoltage protected)	45	V
$-V_{CC}$	Reverse DC supply voltage	-0.3	V
$-I_{GND}$	DC reverse ground pin current	-200	mA
$I_{OUT}$	DC output current	Internally limited	A
$-I_{OUT}$	Reverse DC output current	-5	A
$I_{IN}$	DC input current	+/- 10	mA
$I_{STAT}$	DC status current	+/- 10	mA
$V_{ESD}$	Electrostatic discharge ( R = 1.5 K $\Omega$ ; C = 100 pF )	5000	V
$P_{tot}$	Power dissipation $T_C = 25\text{ }^\circ\text{C}$	Internally limited	W
$T_J$	Junction operating temperature	Internally limited	$^\circ\text{C}$
$T_C$	Case operating temperature	- 40 to 150	$^\circ\text{C}$
$T_{stg}$	Storage temperature	- 55 to 150	$^\circ\text{C}$
$E_{AS}$	Single-pulse avalanche energy	0.8	J

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJA}$	Thermal resistance junction-ambient <sup>(1)</sup> Max	50	$^\circ\text{C}/\text{W}$
$R_{thJC}$	Thermal resistance junction-case Max	3	$^\circ\text{C}/\text{W}$

1. When mounted on a FR4 printed circuit board with 0.5 cm<sup>2</sup> of Cu (at least 35mm thick) connected to all  $V_{CC}$  pins.

## 2 Pin connections

Figure 2. Connection diagram (top view)

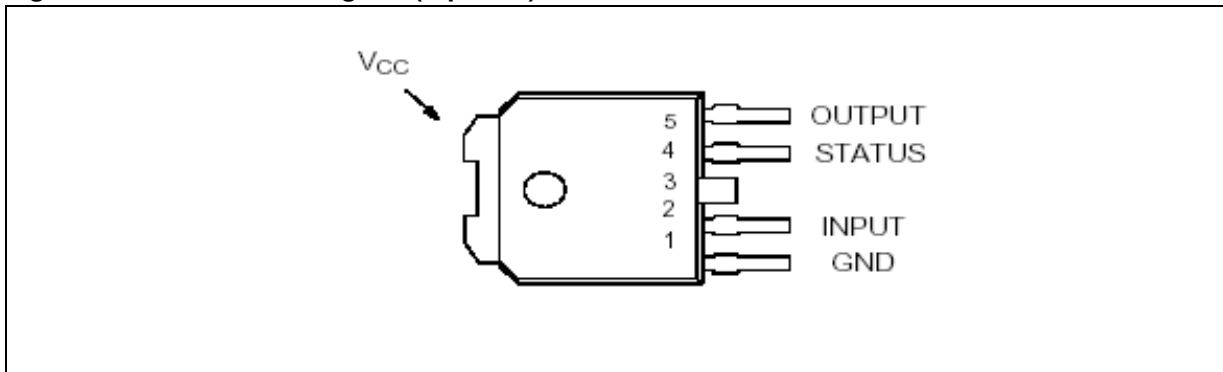
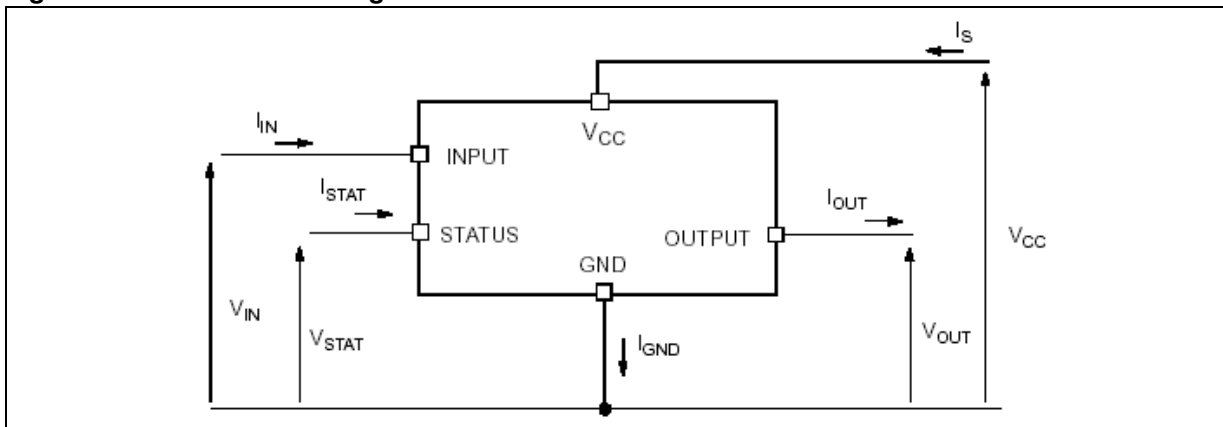


Figure 3. Current and voltage conventions



### 3 Electrical characteristics

$8V < V_{CC} < 36V$ ;  $-40^{\circ}C < T_J < 125^{\circ}C$  unless otherwise specified

**Table 3. Power**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{CC}$	Operating supply voltage		5.5		36	V
$V_{USD}$	Undervoltage shut-down		3	4	5.5	V
$V_{OV}$	Overvoltage shut-down		36			V
$R_{ON}$	On state resistance	$I_{OUT} = 2A$ ; $T_J = 25^{\circ}C$ $I_{OUT} = 2A$		60	180	m $\Omega$ m $\Omega$
$I_S$	Supply current	Off State; $V_{CC} = 24V$ ; $T_{CASE} = 25^{\circ}C$ On State; $V_{CC} = 24V$ On State; $V_{CC} = 24V$ ; $T_{CASE} = 100^{\circ}C$		10 1.5	20 1.8	$\mu A$ mA mA
$I_{L(off)}$	OFF state output current	$V_{IN} = V_{OUT} = 0V$	0		10	$\mu A$

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

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(on)}$	Turn-on delay time	$R_L = 12\Omega$ from $V_{IN}$ rising edge to $V_{OUT} = 2.4V$		12		$\mu s$
$t_{d(off)}$	Turn-off delay time	$R_L = 12\Omega$ from $V_{IN}$ falling edge to $V_{OUT} = 21.6V$		35		$\mu s$
$dV_{OUT}/dt_{(on)}$	Turn-on voltage slope	$R_L = 12\Omega$ from $V_{OUT} = 2.4V$ to $V_{OUT} = 19.2V$		0.80		V/ $\mu s$
$dV_{OUT}/dt_{(off)}$	Turn-off voltage slope	$R_L = 12\Omega$ from $V_{OUT} = 21.6V$ to $V_{OUT} = 2.4V$		0.30		V/ $\mu s$

**Table 5. Input pin**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{IL}$	Input low level				1.25	V
$I_{IL}$	Low level input current	$V_{IN} = 1.25V$	1			$\mu A$
$V_{IH}$	Input high level		3.25			V
$I_{IH}$	High level input current	$V_{IN} = 3.25V$			10	$\mu A$
$V_{hyst}$	Input hysteresis voltage		0.5			V
$I_{IN}$	Input current	$V_{IN} = V_{CC} = 5V$			10	$\mu A$
$V_{ICL}$	Input clamp voltage	$I_{IN} = 1mA$ $I_{IN} = -1mA$	6	6.8 -0.7	8	V V

**Table 6. Status pin**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{STAT}$	Status low output voltage	$I_{STAT} = 1.6mA$			0.5	V
$I_{LSTAT}$	Status leakage current	Normal operation; $V_{STAT} = 5V$			10	$\mu A$
$C_{STAT}$	Status pin input capacitance	Normal operation; $V_{STAT} = 5V$			100	pF
$V_{SCL}$	Status clamp voltage	$I_{STAT} = 1mA$ ; $I_{STAT} = -1mA$	6	6.8 -0.7	8	V V

**Table 7. Protections**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$T_{TSD}$	Shut-down temperature		150	175	200	$^{\circ}C$
$T_R$	Reset temperature		135			$^{\circ}C$
$T_{hyst}$	Thermal hysteresis		7	20		$^{\circ}C$
$I_{lim}$	Current limitation	$V_{CC} = 24V$ , $R_{LOAD} = 10m\Omega$ , $t = 0.4ms$	2.7		6.0	A
$V_{demag}$	Turn-off output clamp voltage	$R_L = 12\Omega$ ; $L = 6mH$	$V_{CC} - 47$	$V_{CC} - 52$	$V_{CC} - 57$	V

## 4 Waveforms and truth table

Figure 4. Switching time waveforms

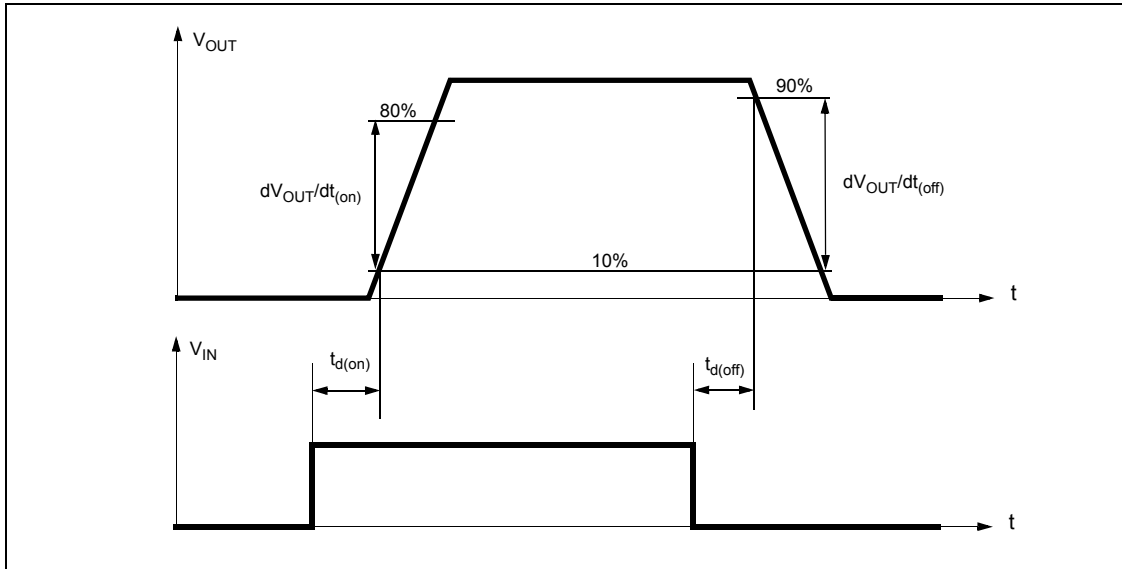
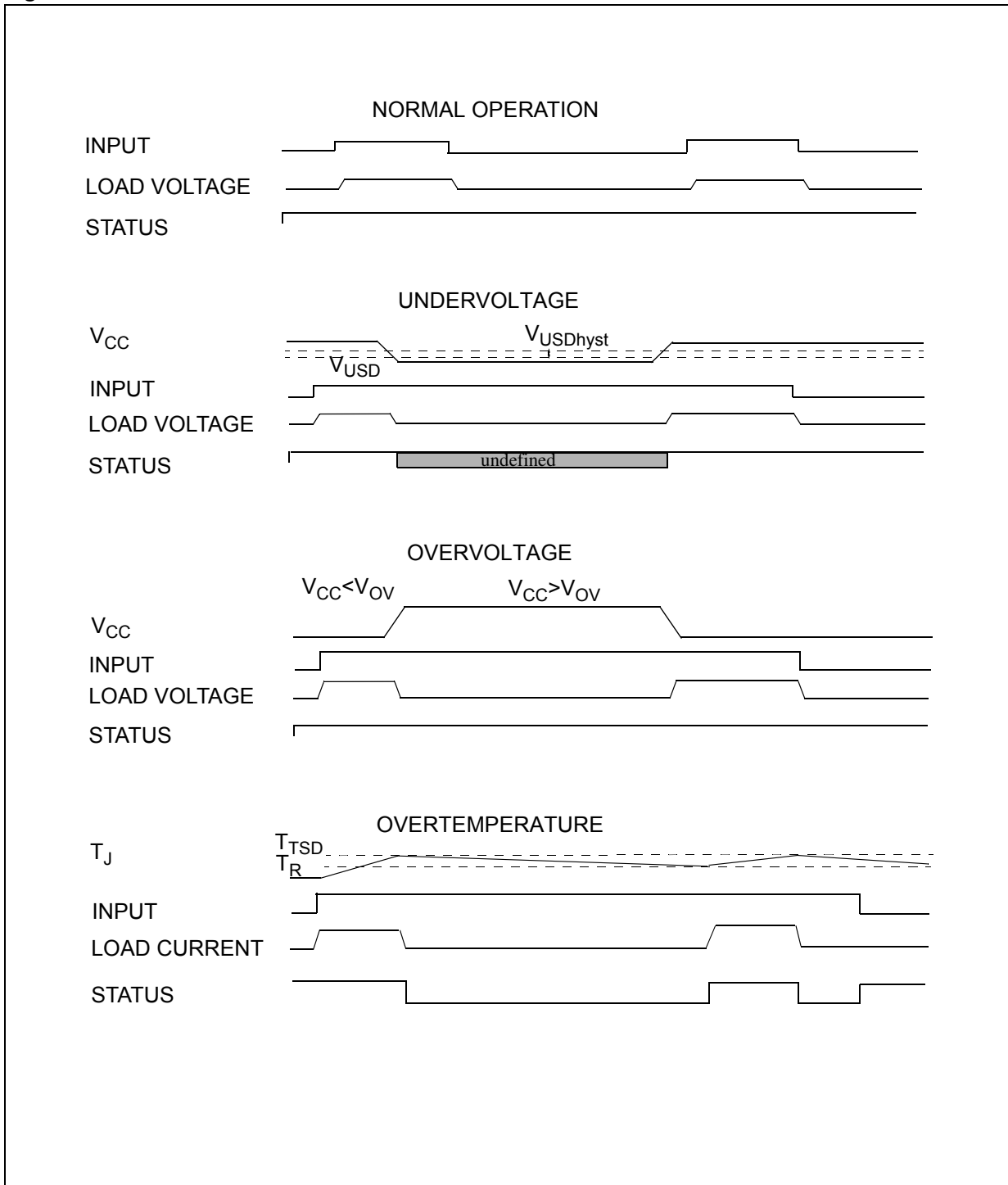


Table 8. Truth table

Conditions	Input	Output	Status
Normal operation	L	L	H
	H	H	H
Current limitation	L	L	H
	H	X	$(T_J < T_{TSD})$ H
	H	X	$(T_J > T_{TSD})$ L
Overtemperature	L	L	H
	H	L	L
Undervoltage	L	L	X
	H	L	X
Overvoltage	L	L	H
	H	L	H

Figure 5. Waveforms





## 5 Test circuit

Figure 6. Peak short circuit current test circuit

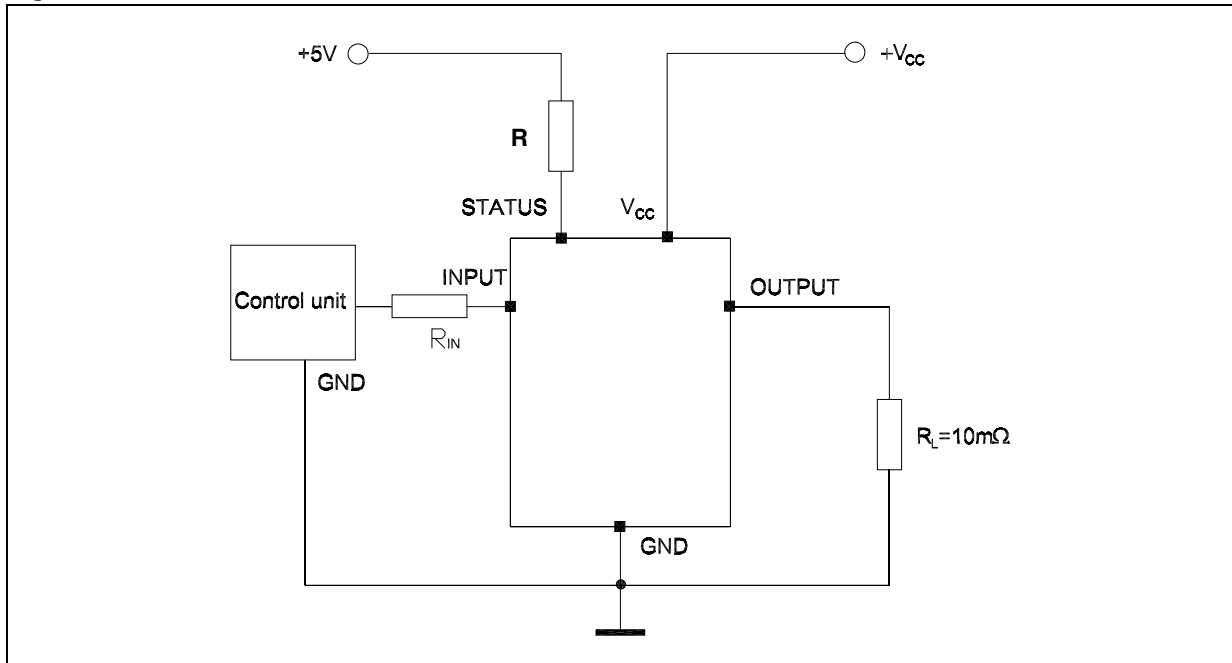
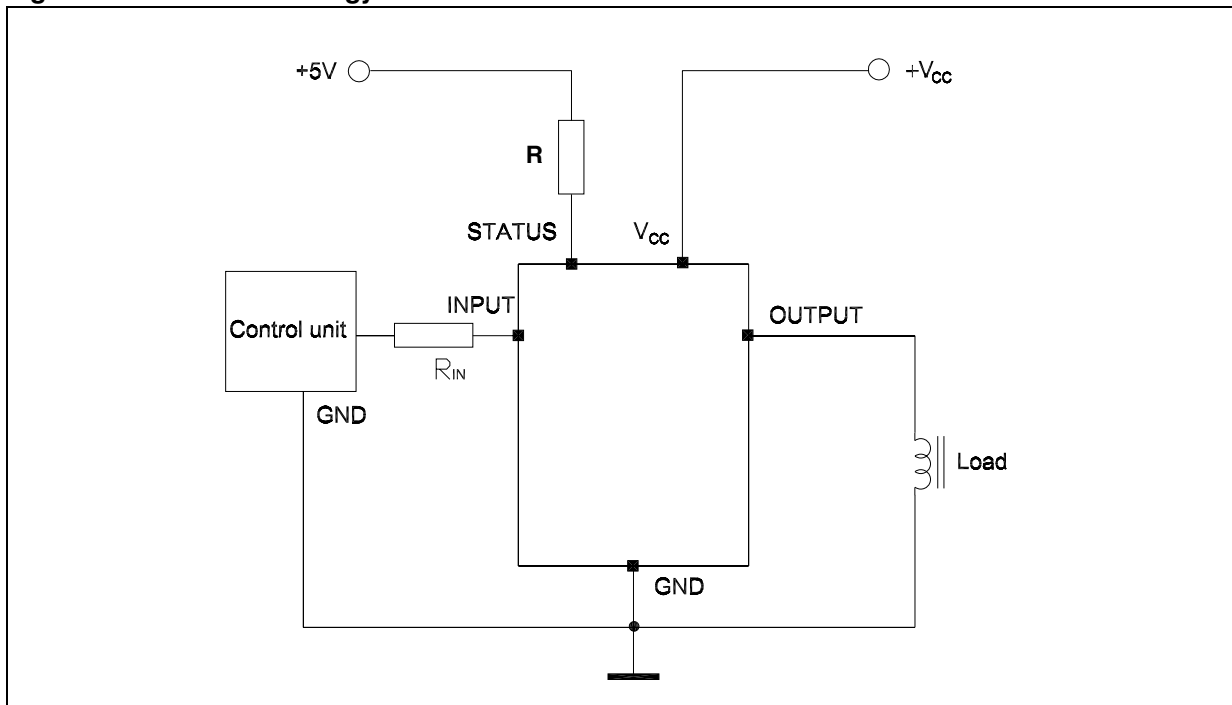
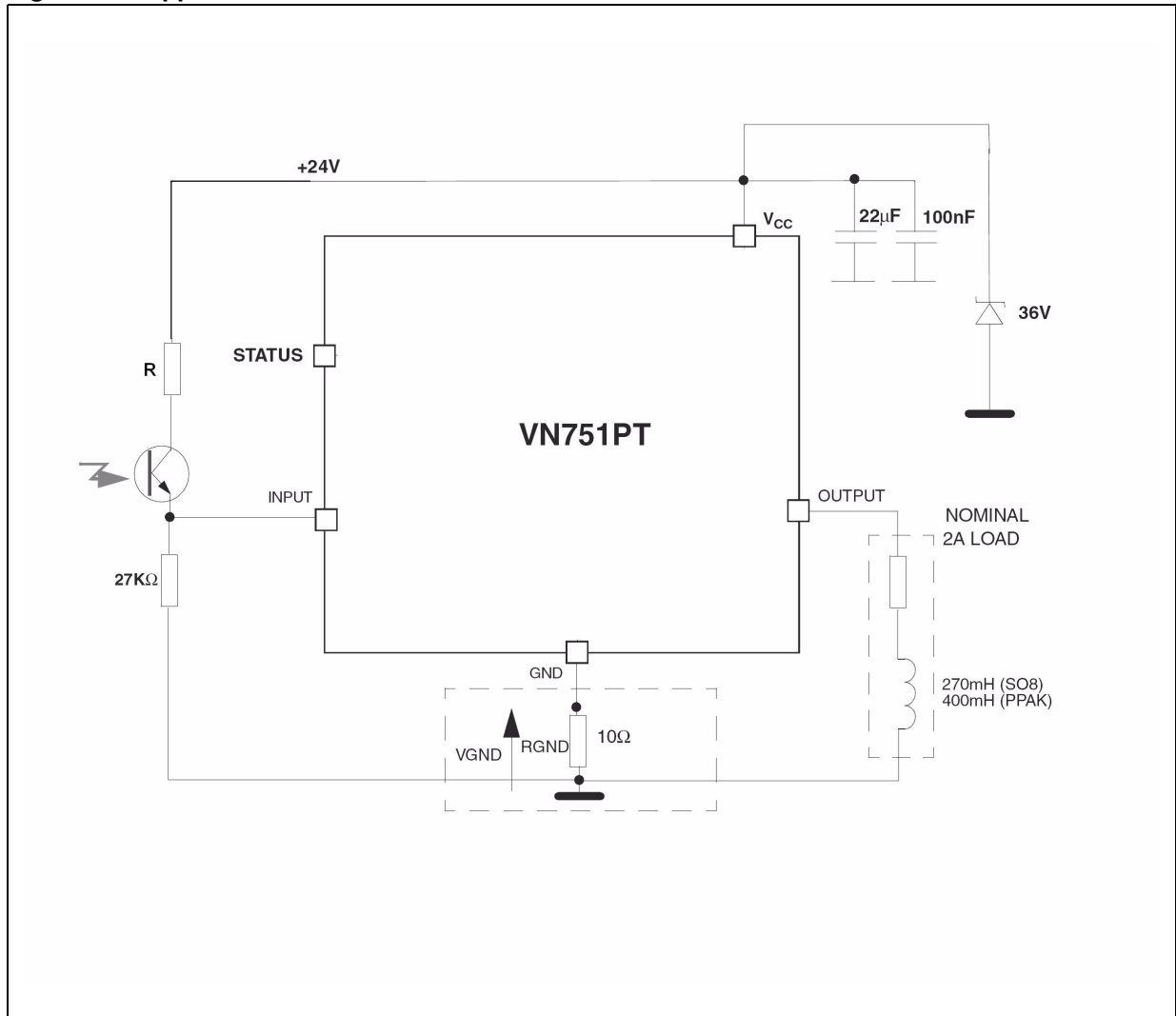


Figure 7. Avalanche energy test circuit



# 6 Application schematic

Figure 8. Application schematic



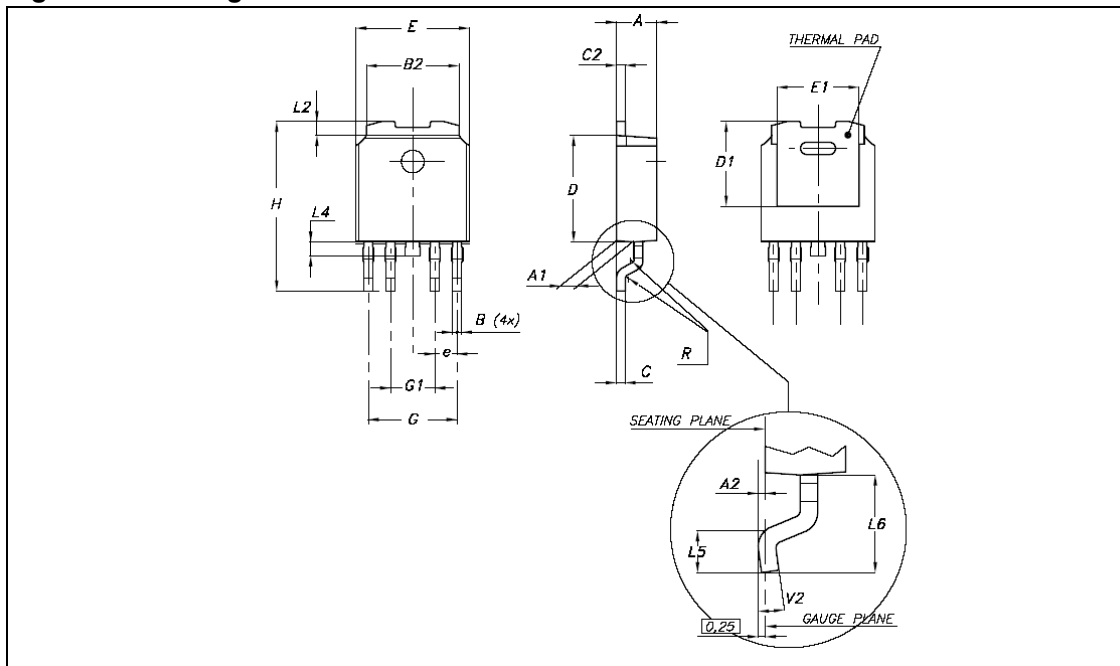
## 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

Table 9. PPAK mechanical data

Dim.	Min	Typ	Max
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
B	0.40		0.60
B2	5.20		5.40
C	0.45		0.60
C2	0.48		0.60
D1		5.1	
D	6.00		6.20
E	6.40		6.60
E1		4.7	
e		1.27	
G	4.90		5.25
G1	2.38		2.70
H	9.35		10.10
L2		0.8	1.00
L4	0.60		1.00
R		0.2	
V2	0°		8°
Package Weight	Gr. 0.3		

Figure 9. Package dimensions



## 8 Order code

Table 10. Order codes

Part number	Package	Packaging
VN751PT	PPAK	Tube
VN751PT13TR	PPAK	Tape and reel

## 9 Revision history

**Table 11. Revision history**

Date	Revision	Changes
07-Mar-2006	1	Initial release
31-Mar-2006	2	Added $V_{SCL}$
10-Jul-2006	3	Updated $V_{CC}$ value <a href="#">Table 1</a> , $I_{lim}$ min value <a href="#">Table 7</a>
12-Mar-2007	4	Typo in <a href="#">Section Table 3.: Power on page 5</a> , updated $P_{tot}$ value <a href="#">Table 1</a> .
15-May-2007	5	Typo in <a href="#">Table 1 on page 3</a> , $V_{ESD}$
18-Sep-2007	6	Added $I_{STAT}$ value in <a href="#">Table 1 on page 3</a>

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