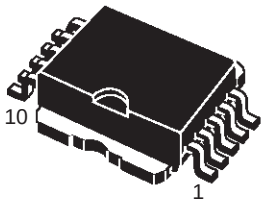
VN610SP

SINGLE CHANNEL HIGH SIDE SOLID STATE RELAY

TARGET SPECIFICATION

TYPE	$R_{DS(on)}$	I_{OUT}	V_{CC}
VN610SP	10mΩ	45A	36 V

- OUTPUT CURRENT : 45 A
- CMOS COMPATIBLE INPUTS
- PROPORTIONAL LOAD CURRENT SENSE
- UNDERVOLTAGE AND OVERVOLTAGE SHUT-DOWN
- OVERVOLTAGE CLAMP
- THERMAL SHUT DOWN
- CURRENT LIMITATION
- VERY LOW STAND-BY POWER DISSIPATION
- PROTECTION AGAINST:
  LOSS OF GROUND AND LOSS OF V_{CC}
- REVERSE BATTERY PROTECTION (*)

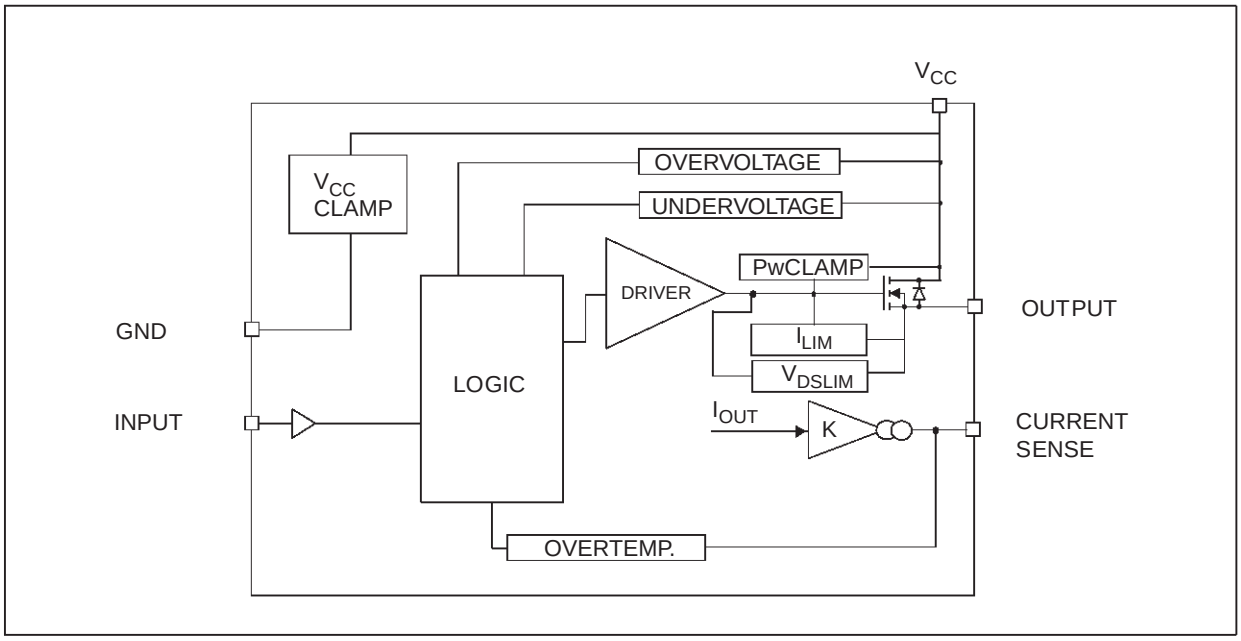


PowerSO-10™

DESCRIPTION

The VN610SP is a monolithic device made using STMicroelectronics VIPower technology. It is intended for driving resistive or inductive loads with one side connected to ground. Active Vcc pin voltage clamp protects the device against low energy spikes (see ISO7637 transient compatibility table). It has an analog sense output on which the sensing current is proportional (according to a known ratio) to the corresponding load current. Built-in thermal shut-down and outputs current limitation protects the chip from over temperature and short circuit. Device automatically turns off in case of ground pin disconnection.

BLOCK DIAGRAM

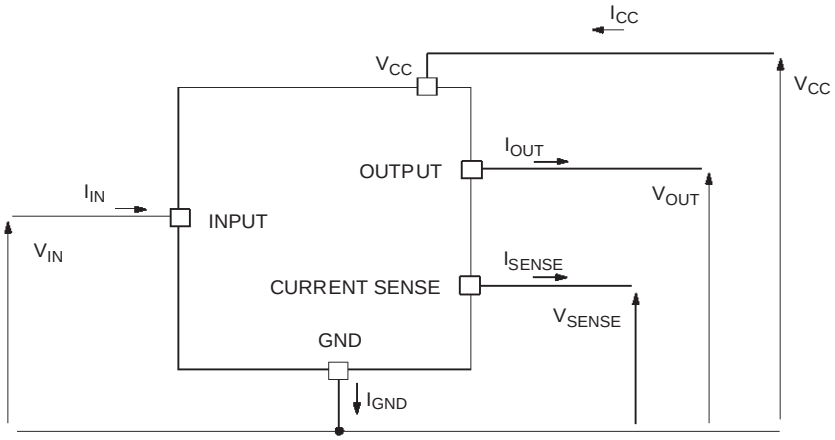


(*) See note at page 4

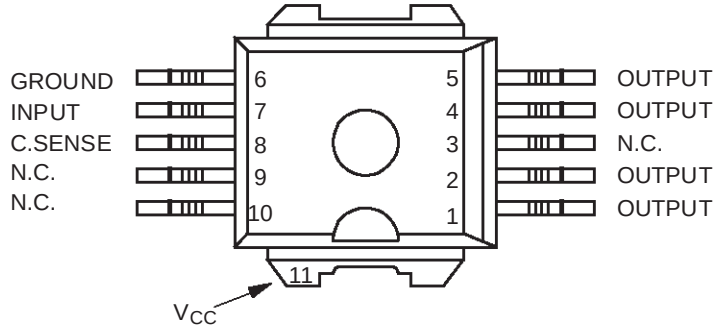
ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage (continuous)	41	V
$-V_{CC}$	Reverse supply voltage (continuous)	-0.3	V
I_{OUT}	Output current (continuous)	Internally limited	A
I_R	Reverse output current (continuous)	-55	A
I_{IN}	Input current	+/- 10	mA
V_{CSENSE}	Current sense maximum voltage	-3 +15	V V
I_{GND}	Ground current at $T_C \leq 25\ ^oC$ (continuous)	-200	mA
V_{ESD}	Electrostatic discharge (R=1.5kΩ, C=100pF)	2000	V
P_{TOT}	Power dissipation at $T_C \leq 25\ ^oC$	110	W
T_j	Junction operating temperature	-40 to 150	°C
T_{STG}	Storage temperature	-65 to 150	°C

CURRENT AND VOLTAGE CONVENTIONS



CONNECTION DIAGRAM (TOP VIEW)



THERMAL DATA

Symbol	Parameter		Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	(MAX)	1.1	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	(MAX)	50	°C/W

ELECTRICAL CHARACTERISTICS (Vcc=9V up to 16V; -40°C<Tj<150°C; unless otherwise specified)

POWER

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{CC}	Operating supply voltage		5.5	13	36	V
V_{USD}	Under voltage shut down		3	4	5	V
V_{OV}	Overvoltage shut down	(see Note 1)	36	39	45	V
R_{ON}	On state resistance	I_{OUT}=15A; Tj=25°C I_{OUT}=15A; Tj=150°C I_{OUT}=9A; V_{CC}=6V			10 20 35	mΩ mΩ mΩ
V_{clamp}	Clamp Voltage	I_{CC}=20 mA (see note 1)	41	45	50	V
I_S	Supply current	Off state; INPUT= n.c. On state; V_{IN}=5V; Current Sense Open			30 5	µA mA
I_{loff}	Off state output current	V_{IN}=V_{OUT}=0V	0		50	µA

Note 1: V_{clamp} and V_{OV} are correlated. Typical difference is 5V.

SWITCHING (VCC=13V)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$t_{D(on)}$	Turn-on delay time	R1=0.87Ω		50		µs
$t_{D(off)}$	Turn-on delay time	R1=0.87Ω		50		µs
$(dV_{OUT}/dt)_{on}$	Turn-on voltage slope	R1=0.87Ω		0.3		V/µs
$(dV_{OUT}/dt)_{off}$	Turn-off voltage slope	R1=0.87Ω		0.3		V/µs
W_{ON}	Switching losses energy at Turn-on	R1=2.6Ω		1.0		mJ
W_{OFF}	Switching losses energy at Turn-off	R1=2.6Ω		0.5		mJ

PROTECTIONS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_{LIM}	DC Short circuit current	V_{CC}=13V	45	75	120	A
T_{TSD}	Thermal shut down temperature		150	175	200	°C
T_{TR}	Thermal reset temperature		135			°C
V_{demag}	Turn-off output voltage clamp	I_{OUT}=2A; V_{IN}=0; L=6mH	Vcc-41	Vcc-45	Vcc-51	V
T_{HYST}	Thermal hysteresis		7	15		°C
V_{ON}	Output voltage drop limitation	I_{OUT}=1.5A T_j= -40 °C...+150 °C		50		mV

CURRENT SENSE

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_{SENSE1}	Analog Sense Current	I_{OUT} =15A; V_{SENSE}=4V	-10%	TBD	+10%	mA

ELECTRICAL CHARACTERISTICS(continued)

CURRENT SENSE

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_{SENSE2}	Analog Sense Current	I_{OUT}=1.5A; V_{SENSE}=0.5V	-50%	TBD	+50%	mA
V_{SENSE}	Max Analog Sense Output Voltage	V_{CC}=5V; I_{OUT} =7.5A; R_{SENSE}=10KΩ V_{CC} >8V; I_{OUT}=15A; R_{SENSE}=10KΩ	2 4			V V
V_{SENSEH}	Analog Sense Output Voltage in Overtemp. Condition	V_{CC}=13V; T_j= 25^{0}C; R_{SENSE}=3.9KΩ		5.5		V

LOGIC INPUTS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IL}	Input Low Level Voltage				1.25	V
V_{IH}	Input High Level Voltage		3.25			V
V_{HYST}	Input Hysteresis Voltage		0.5			V
I_{IL}	Low Level Input Current	V_{IN}=1.25V	1			µA
I_{IH}	High Level Input Current	V_{IN}=3.25V			10	µA
V_{ICL}	Input Clamp Voltage	I_{IN}=1mA I_{IN}=-1mA	6.5	7.4 -0.7	8.5	V V

TRUTH TABLE

CONDITIONS	INPUT	OUTPUT	SENSE
Normal Operation	L H	L H	0 Nominal
Overtemperature	L H	L L	0 V_{SENSEH}
UnderVoltage	L H	L L	0 0
OverVoltage	L H	L L	0 0
Short Circuit to GND	L H	L L	0 0
Short Circuit to V_{CC}	L H	H H	0 < Nominal
Negative Output Voltage Clamp	L	L	0

PROTECTING THE DEVICE AGAINST REVERSE BATTERY

The simplest way to protect the device against a continuous reverse battery voltage is to insert a resistor paralleled to a Schottky diode between the ground pin of the device and the ground of the system. The proposed value for the resistance is 1KΩ. This way is suggested working with inductive loads. For resistive loads only, a suitable protection is to use one 150Ω resistor. In this case the value of the resistance is chosen by taking in account the current consumption through the ground pin.

ELECTRICAL TRANSIENT REQUIREMENTS

ISO T/R 7637/1 Test Pulse	Test Levels I	Test Levels II	Test Levels III	Test Levels IV	Test Levels Delays and Impedance
1	-25V	-50V	-75V	-100V	2ms, 10Ω
2	+25V	+50V	+75V	+100V	0.2ms, 10Ω
3a	-25V	-50V	-100V	-150V	0.1µs, 50Ω
3b	+25V	+50V	+75V	+100V	0.1µs, 50Ω
4	-4V	-5V	-6V	-7V	100ms, 0.01Ω
5	+26.5V	+46.5V	+66.5V	+86.5V	400ms, 2Ω

ISO T/R 7637/1 Test Pulse	Test Levels Result I	Test Levels Result II	Test Levels Result III	Test Levels Result IV
1	C	C	C	C
2	C	C	C	C
3a	C	C	C	C
3b	C	C	C	C
4	C	C	C	C
5	C	E	E	E

Class	Contents
C	All functions of the device are performed as designed after exposure to disturbance.
E	One or more functions of the device is not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

SWITCHING CHARACTERISTICS

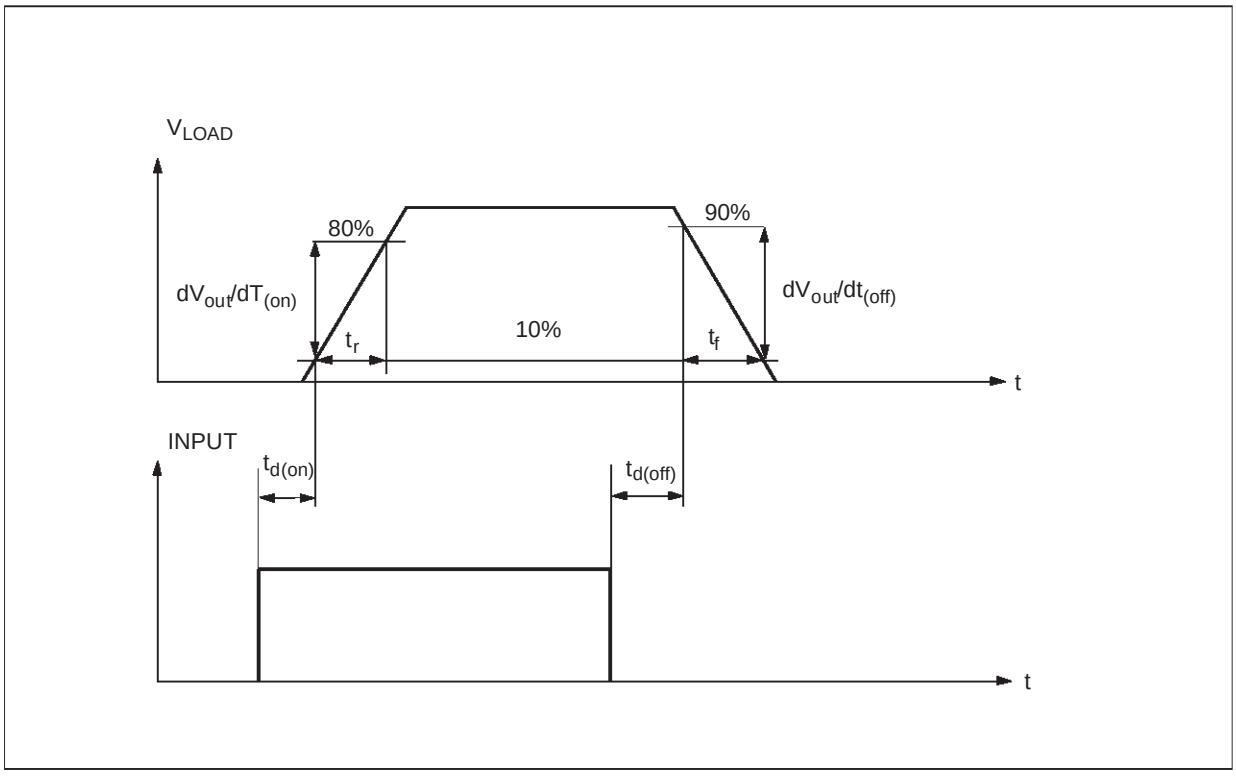
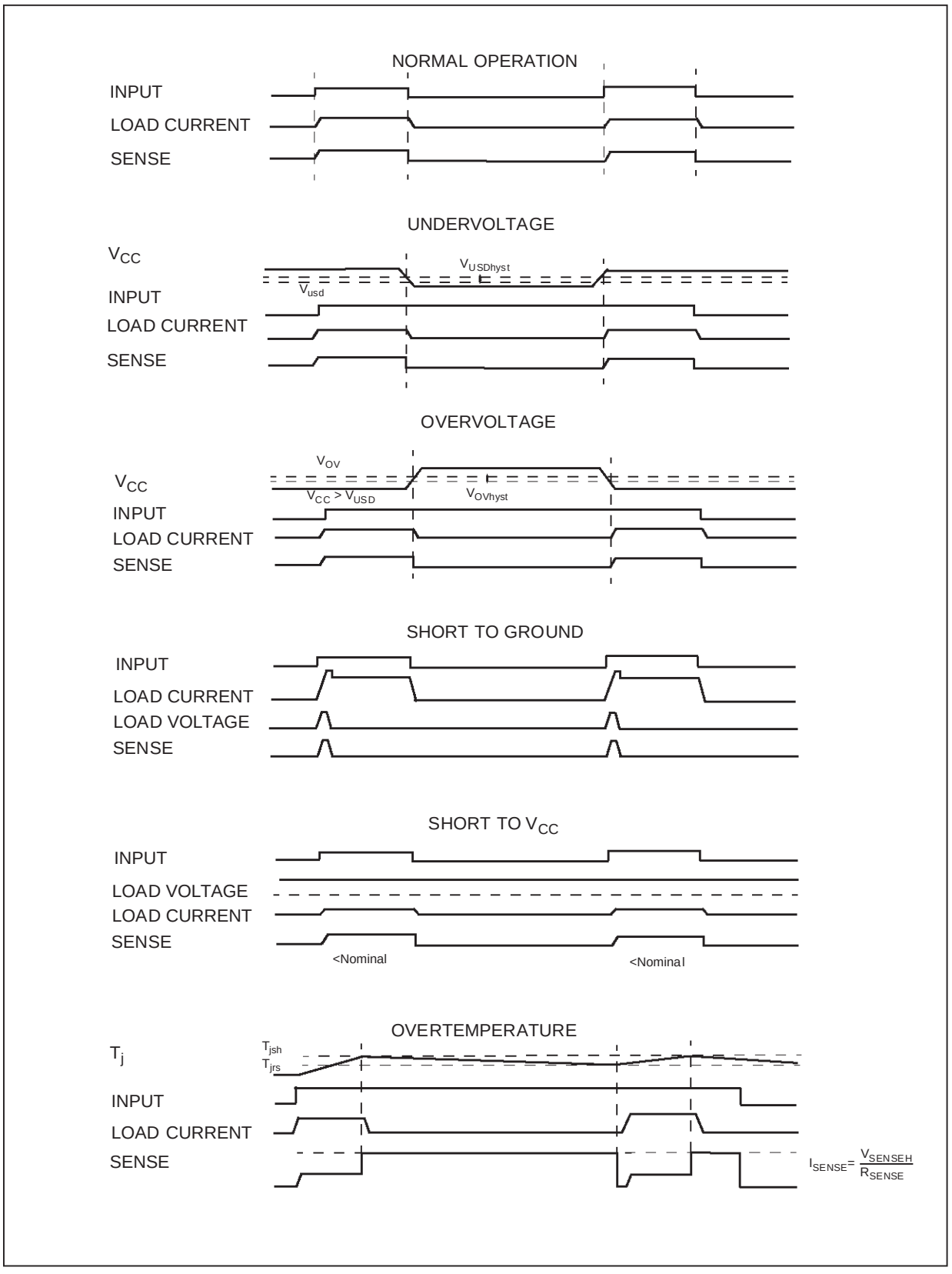


Figure1: Waveforms



PowerSO-10™ MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	3.35		3.65	0.132		0.144
A1	0.00		0.10	0.000		0.004
B	0.40		0.60	0.016		0.024
c	0.35		0.55	0.013		0.022
D	9.40		9.60	0.370		0.378
D1	7.40		7.60	0.291		0.300
E	9.30		9.50	0.366		0.374
E1	7.20		7.40	0.283		0.291
E2	7.20		7.60	0.283		300
E3	6.10		6.35	0.240		0.250
E4	5.90		6.10	0.232		0.240
e		1.27			0.050	
F	1.25		1.35	0.049		0.053
H	13.80		14.40	0.543		0.567
h		0.50			0.002	
Q		1.70			0.067	
α	0º		8º