

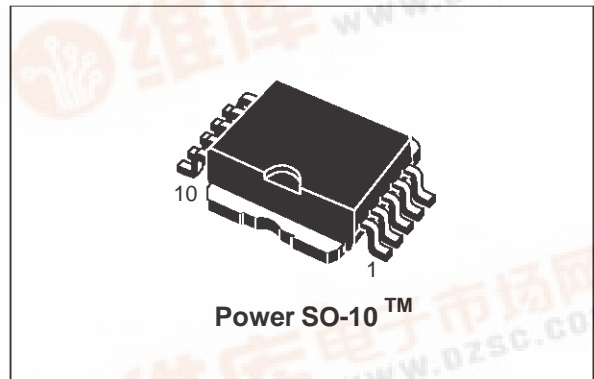


# VN460SP

## SINGLE CHANNEL HIGH SIDE SMART SOLID STATE RELAY

TYPE	V <sub>demag</sub>	R <sub>DS(on)</sub>	I <sub>OUT</sub>	V <sub>CC</sub>
VN460SP	V <sub>CC</sub> -55V	20 mΩ	25 A	36 V

- OUTPUT CURRENT (CONTINUOUS):  
25 A @ T<sub>C</sub> = 25 °C
- 5 V LOGIC LEVEL COMPATIBLE INPUT
- UNDER VOLTAGE SHUT-DOWN
- OVER VOLTAGE SHUT-DOWN
- THERMAL SHUT-DOWN
- OPEN DRAIN DIAGNOSTIC OUTPUT
- VERY LOW STAND-BY POWER DISSIPATION



### DESCRIPTION

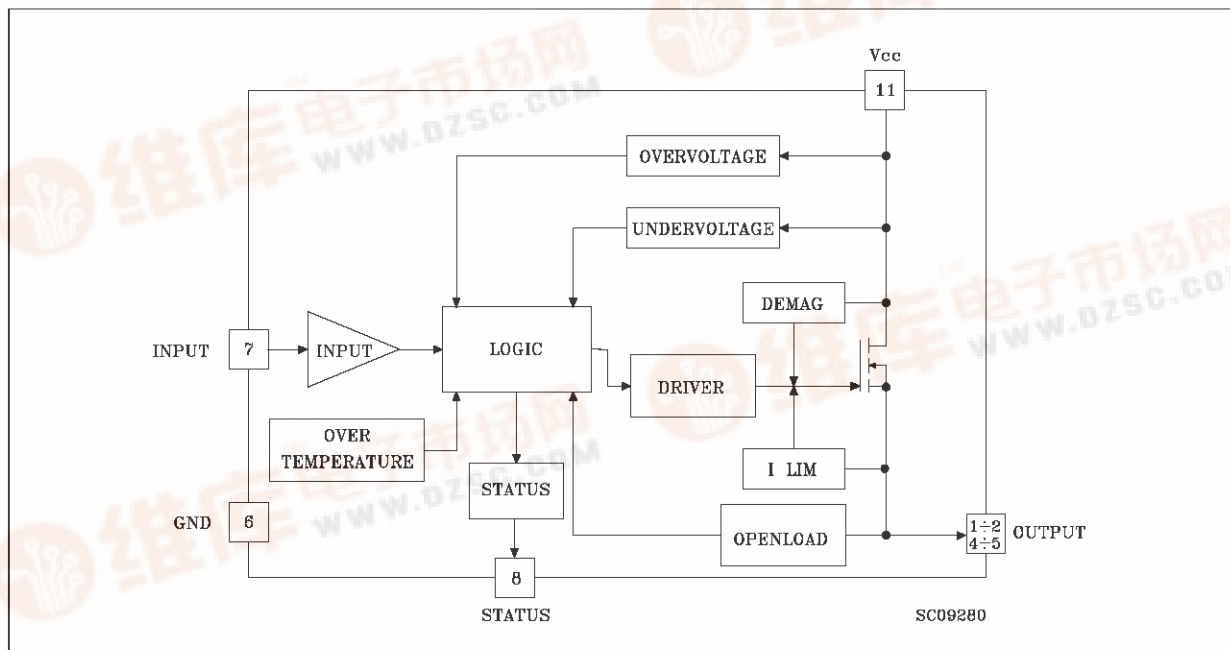
The VN460SP is a monolithic device made using SGS-THOMSON Vertical Intelligent Power Technology, intended for driving resistive or inductive loads with one side connected to ground.

Built-in thermal shut-down protects the chip from over temperature and short circuit.

The control input is 5V CMOS logic level compatible.

The open drain diagnostic output indicates open circuit (no load) and overtemperature status.

### BLOCK DIAGRAM

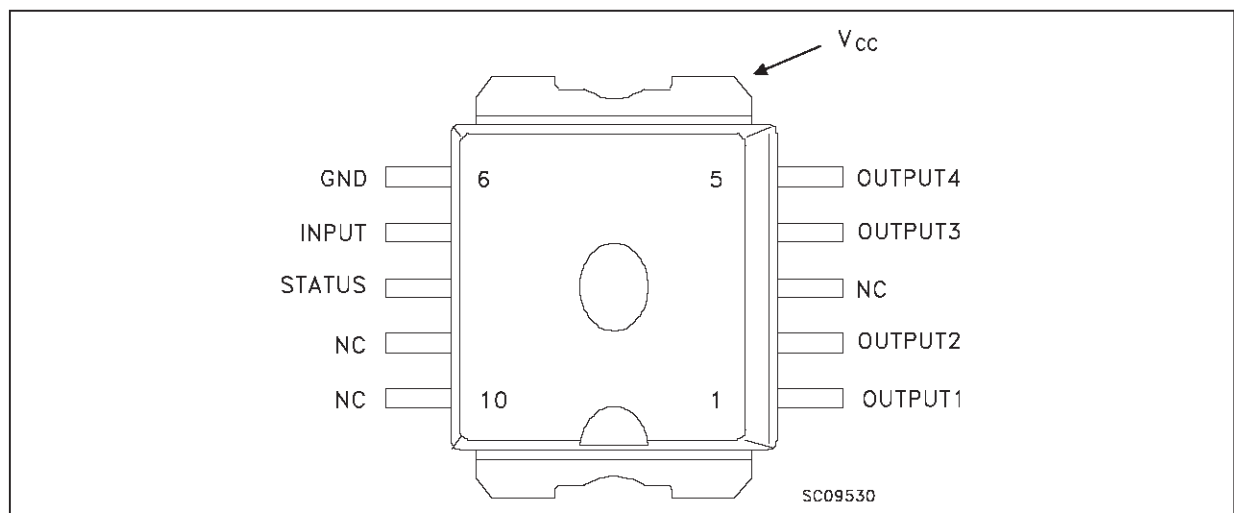


# VN460SP

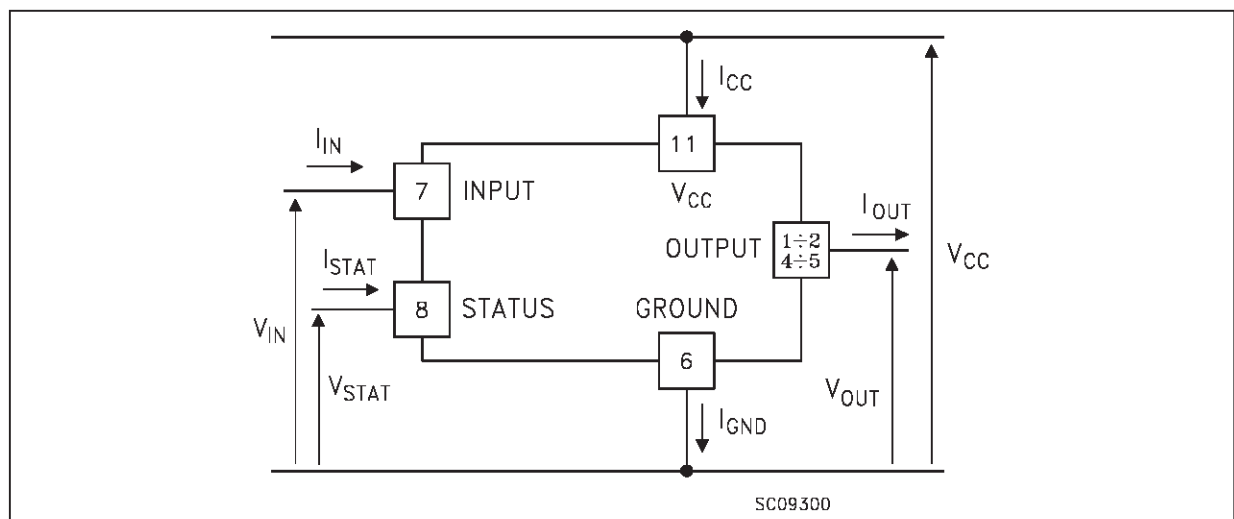
## ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
$V_{CC}$	Power Supply Voltage (continuous)	45	V
$-V_{CC}$	Reverse Supply Voltage (continuous)	-0.3	V
$I_{OUT}$	Output Current (continuous)	Internally Limited	A
$I_R$	Reverse Output Current	-25	A
$I_{IN}$	Input Current	$\pm 10$	mA
$I_{STAT}$	Status Pin Current	$\pm 10$	mA
$-I_{GND}$	Reverse Ground Current	-200	mA
$V_{ESD}$	Electrostatic Discharge (1.5 k $\Omega$ , 100 pF)	2000	V
$P_{tot}$	Power Dissipation at $T_c \leq 25$ °C	112	W
$T_j$	Junction Operating Temperature	-40 to 150	°C
$T_{stg}$	Storage Temperature	-55 to 150	°C

## CONNECTION DIAGRAM



## CURRENT AND VOLTAGE CONVENTIONS



## ELECTRICAL TRANSIENTS REQUIREMENTS

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

ISO T/R 7637/1 Test Pulse	TEST LEVELS RESULTS				
	I	II	III	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	

(With a series resistor  $\geq 1$  K $\Omega$  in input and status pins).

CLASS	CONTENTS
C	All function 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.

## VN460SP

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.1	°C/W
R <sub>thj-a(*)</sub>	Thermal Resistance Junction-ambient	Max	50	°C/W

(\*) When mounted using minimum recommended pad size on FR-4 board.

### ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 13 V; -40 °C < T<sub>J</sub> < 125 °C unless otherwise specified)

#### POWER

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>CC</sub>	Operating Supply Voltage		5.5	13	36	V
V <sub>USD</sub>	Under Voltage Shut Down		3	4	5.5	V
V <sub>OV</sub>	Overvoltage Shut Down		36	39	45	V
R <sub>on</sub>	On State Resistance	I <sub>OUT</sub> = 5 A I <sub>OUT</sub> = 5 A T <sub>J</sub> = 25 °C			20 36	mΩ mΩ
I <sub>S</sub>	Supply Current	Off state On State T <sub>Case</sub> = 25 °C		15 1.4	30 3.3	μA mA

#### LOGIC INPUT

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>IL</sub>	Input Low Level Voltage	(*)			1.5	V
V <sub>IH</sub>	Input High Level Voltage (see note 1)	(*)	3.5			V
V <sub>I(hyst.)</sub>	Input Hysteresis Voltage		0.2	0.85	1.5	V
I <sub>IN</sub>	Input Current	V <sub>IN</sub> = 5 V T <sub>Case</sub> = 25 °C			100	μA
V <sub>ICL</sub>	Input Clamp Voltage	I <sub>IN</sub> = 10 mA I <sub>IN</sub> = -10 mA	5	6 -0.7	7	V V

(\*) : The input voltage is internally clamped at 6 V about. It is possible to connect this pin to an higher voltage via an external resistor provided the input current does not exceed 10 mA.

#### SWITCHING (V<sub>CC</sub> = 13 V)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on Delay Time Of Output Current	I <sub>OUT</sub> = 5 A Resistive Load Input Rise Time < 0.1 μs T <sub>J</sub> = 25 °C	25	90	250	μs
t <sub>r</sub>	Rise Time Of Output Current	I <sub>OUT</sub> = 5 A Resistive Load Input Rise Time < 0.1 μs T <sub>J</sub> = 25 °C	80	300	650	μs
t <sub>d(off)</sub>	Turn-off Delay Time Of Output Current	I <sub>OUT</sub> = 5 A Resistive Load Input Rise Time < 0.1 μs T <sub>J</sub> = 25 °C	300	750	1500	μs
t <sub>f</sub>	Fall Time Of Output Current	I <sub>OUT</sub> = 5 A Resistive Load Input Rise Time < 0.1 μs T <sub>J</sub> = 25 °C	80	200	400	μs
(di/dt) <sub>on</sub>	Turn-on Current Slope	I <sub>OUT</sub> = 5 A		0.02	0.05	A/μs
(di/dt) <sub>off</sub>	Turn-off Current Slope	I <sub>OUT</sub> = 5 A		0.02	0.05	A/μs

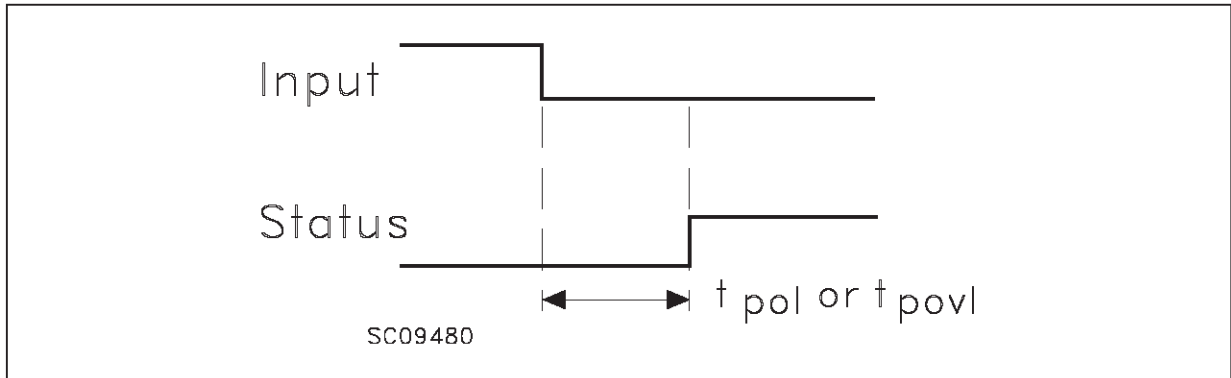
**ELECTRICAL CHARACTERISTICS** (continued)

## PROTECTIONS AND DIAGNOSTICS

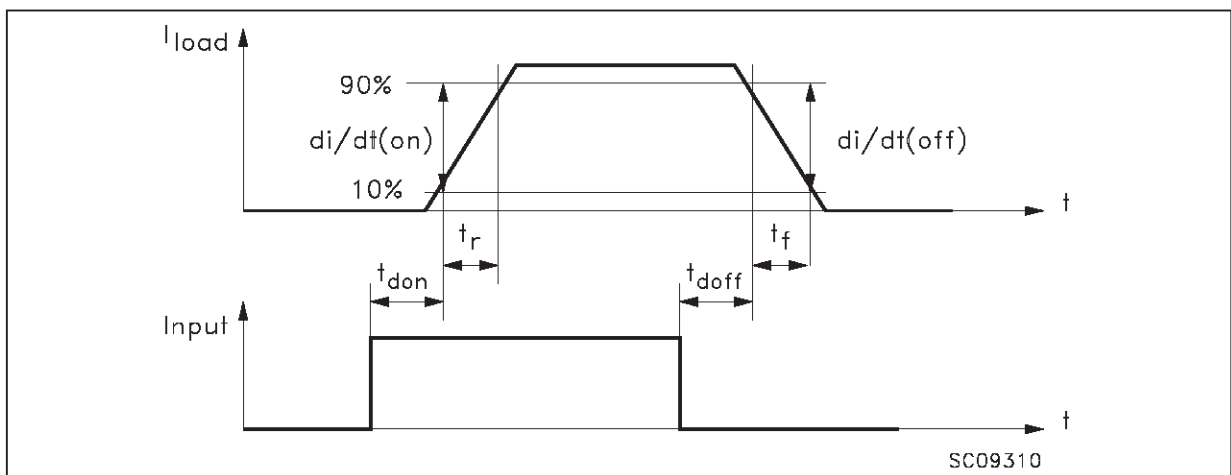
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
T <sub>TSD</sub>	Thermal Shut-down Temperature		150	170	190	°C
T <sub>TR</sub>	Thermal Reset Temperature		135			°C
T <sub>RS</sub> (HYST)	Thermal Hysteresis		5	15	50	°C
V <sub>ENOL</sub>	Output Voltage Authorizing Openload Detection	8V ≤ V <sub>CC</sub> ≤ 30V	5.2	6.6	8	V
I <sub>OL</sub>	Open Load Current Level	8V ≤ V <sub>CC</sub> ≤ 30V	100	800	1500	mA
I <sub>OV</sub>	Over Current	R <sub>LOAD</sub> ≤ 10 mΩ - 40°C < T <sub>Case</sub> < 125°C	25	50		A
I <sub>AV</sub>	Average Current in Short Circuit	R <sub>LOAD</sub> ≤ 10 mΩ T <sub>C</sub> = 85°C		5.4		A
V <sub>STAT</sub>	Status Output Voltage	I <sub>STAT</sub> = 1.6 mA (Fault Condition)			0.4	V
V <sub>SCL</sub>	Status Clamp Voltage	I <sub>STAT</sub> = 10 mA I <sub>STAT</sub> = -10 mA	5.5	6 -0.7	7	V V
t <sub>POL</sub>	Status Delay	(*)	50	300	950	μs
t <sub>POVL</sub>	Status Delay	(*)			10	μs
V <sub>DEMAG</sub>	Turn-off Output Clamp Voltage	I <sub>OUT</sub> = 5 A, L = 1 mH, V <sub>IN</sub> = 0	V <sub>CC</sub> -45	V <sub>CC</sub> -50	V <sub>CC</sub> -55	V

(\*) ISO definitions T<sub>POL</sub> = Status delay in case of open load conditions  
T<sub>POVL</sub> = Status delay in case of over load conditions

FIGURE 1



SWITCHING PARAMETERS TEST CONDITIONS

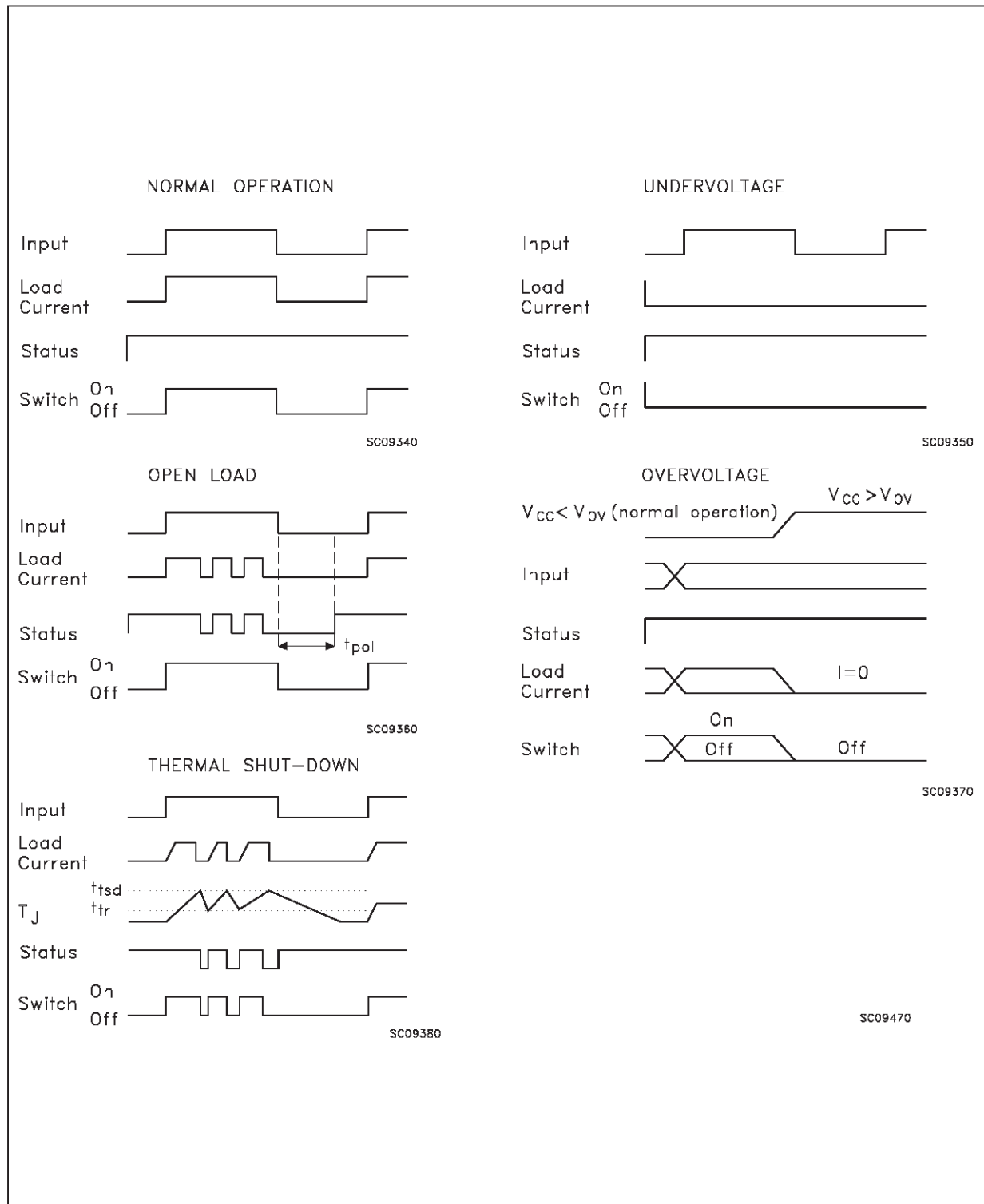


TRUTH TABLE

Conditions	INPUT	OUTPUT	STATUS
Normal Operation	L	L	H
	H	H	H
Over-voltage	X	L	H
Under-voltage	X	L	H
Thermal shut-down	H	L	L
Open load	H	H	L

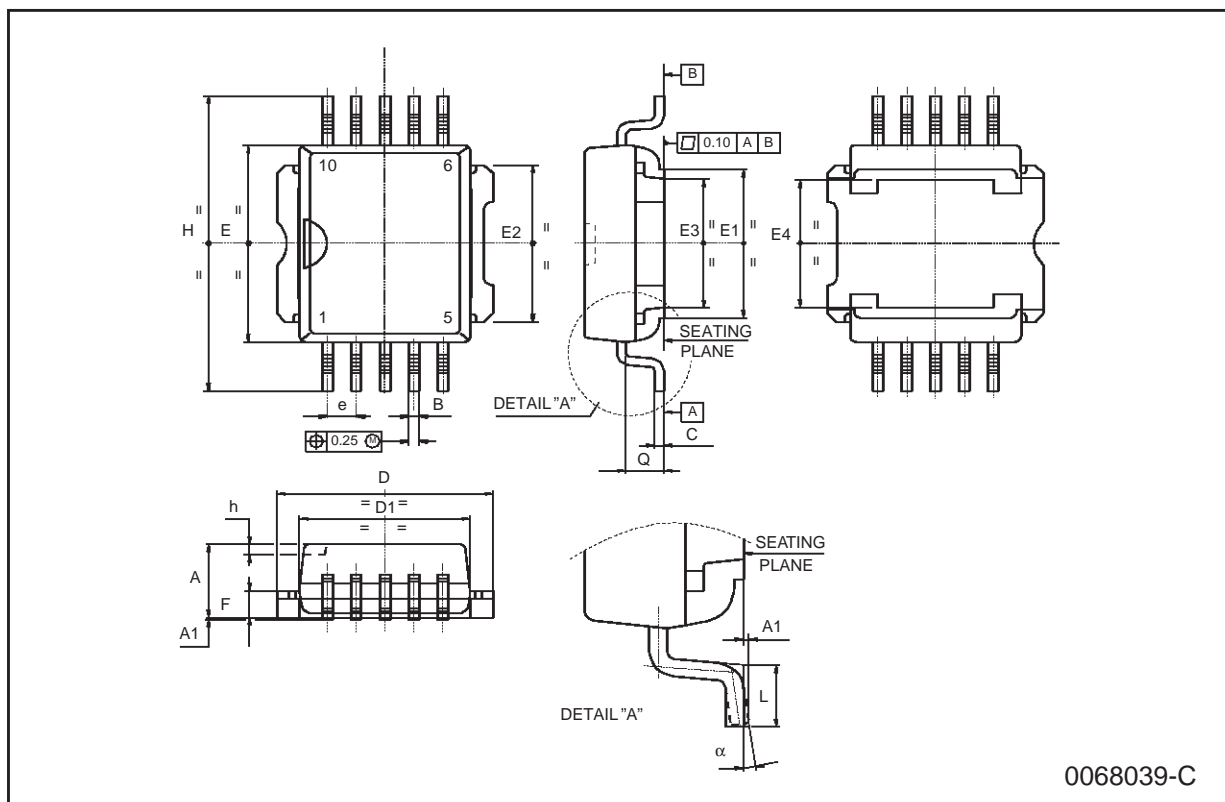
H = high level, L= low level, X= unspecified

FIGURE 2: Switching 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		0.300
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	
L	1.20		1.80	0.047		0.071
q		1.70			0.067	
$\alpha$	0°		8°			





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