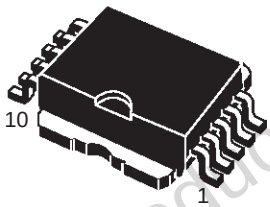
# VN460SP

## SINGLE CHANNEL HIGH SIDE SMART SOLID STATE RELAY

| TYPE | $V_{demag}$ | $R_{DS(on)}$ | IOUT | $V_{CC}$ |
|---|---|---|---|---|
| VN460SP | $V_{CC}$-55V | 20 m Ω | 25 A | 36 V |

- OUTPUT CURRENT (CONTINUOUS): 25 A @ $T_C$ = 25 $^{o}$ 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




**Power SO-10 ™**



### DESCRIPTION

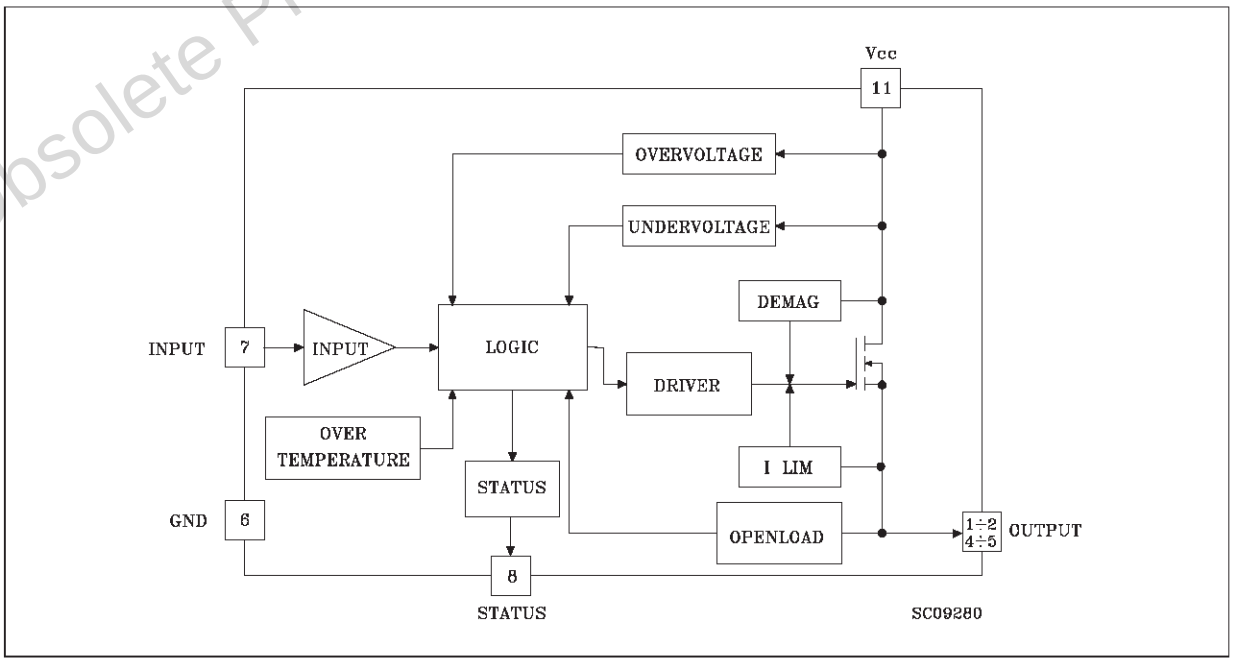
The VN460SP is a monolithic device made using SGS-THOMSON Vertical Intelligent Power Technology, intended for driving resistive or inductive loads with one side connected to ground.

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.

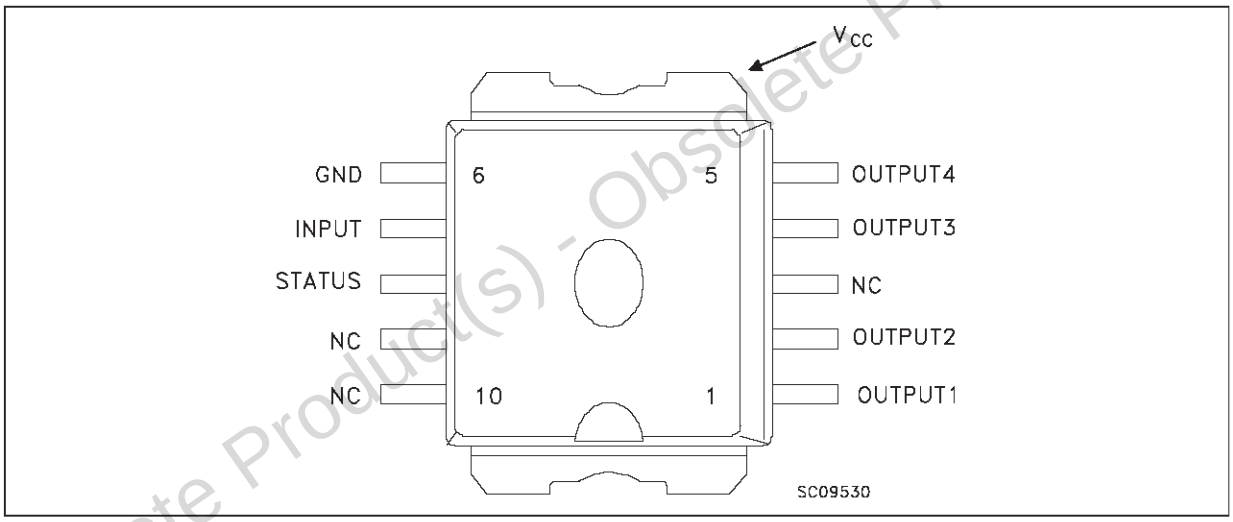
### BLOCK DIAGRAM



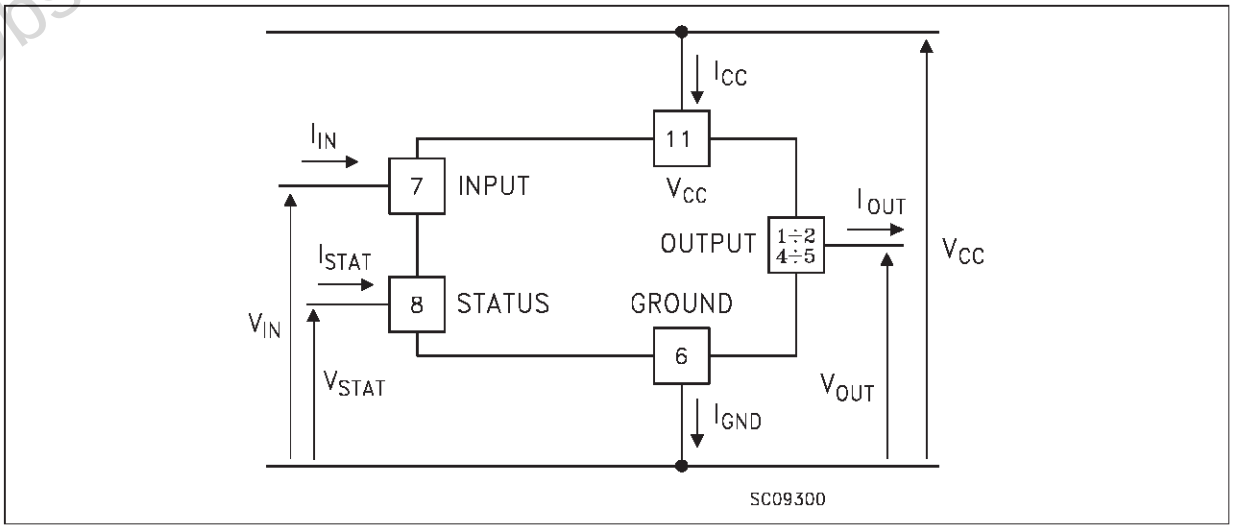
## ABSOLUTE MAXIMUM RATING

| 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 | ±10 | mA |
| $I_{STAT}$ | Status Pin Current | ±10 | mA |
| $-I_{GND}$ | Reverse Ground Current | -200 | mA |
| $V_{ESD}$ | Electrostatic Discharge (1.5 kΩ, 100 pF) | 2000 | V |
| $P_{tot}$ | Power Dissipation at $T_c \leq 25\ ^oC$ | 112 | W |
| $T_j$ | Junction Operating Temperature | -40 to 150 | $^oC$ |
| $T_{stg}$ | Storage Temperature | -55 to 150 | $^oC$ |

## 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 Ω |
| 2 | +25 V | +50 V | +75 V | +100 V | 0.2 ms, 10 Ω |
| 3a | -25 V | -50 V | -100 V | -150 V | 0.1 µs, 50 Ω |
| 3b | +25 V | +50 V | +75 V | +100 V | 0.1 µs, 50 Ω |
| 4 | -4 V | -5 V | -6 V | -7 V | 100 ms, 0.01 Ω |
| 5 | +26.5 | +46.5 | +66.5 | +86.5 | 400 ms, 2 Ω |

| 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 ≥ 1 KΩ 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. |

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 1.1 | °C/W |
| $R_{thj\text{-}a(*)}$ | Thermal Resistance Junction-ambient | Max | 50 | °C/W |

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

## ELECTRICAL CHARACTERISTICS ($V_{CC}$ = 13 V; -40 °C < $T_J$ < 125 °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 | 5.5 | V |
| $V_{ov}$ | Overvoltage Shut Down | | 36 | 39 | 45 | V |
| $R_{on}$ | On State Resistance | $I_{OUT}$ = 5 A $T_J$ = 25 °C<br>$I_{OUT}$ = 5 A | | | 20<br>36 | mΩ<br>mΩ |
| $I_S$ | Supply Current | Off state $T_{Case}$ = 25 °C<br>On State | | 15<br>1.4 | 30<br>3.3 | µA<br>mA |

LOGIC INPUT

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Input Low Level Voltage | (*) | | | 1.5 | V |
| $V_{IH}$ | Input High Level Voltage (see note 1) | (*) | 3.5 | | | V |
| $V_{I(hyst.)}$ | Input Hysteresis Voltage | | 0.2 | 0.85 | 1.5 | V |
| $I_{IN}$ | Input Current | $V_{IN}$ = 5 V $T_{case}$ = 25 °C | | | 100 | µA |
| $V_{ICL}$ | Input Clamp Voltage | $I_{IN}$ = 10 mA<br>$I_{IN}$ = -10 mA | 5 | 6<br>-0.7 | 7 | V<br>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 ($V_{CC}$ = 13 V)

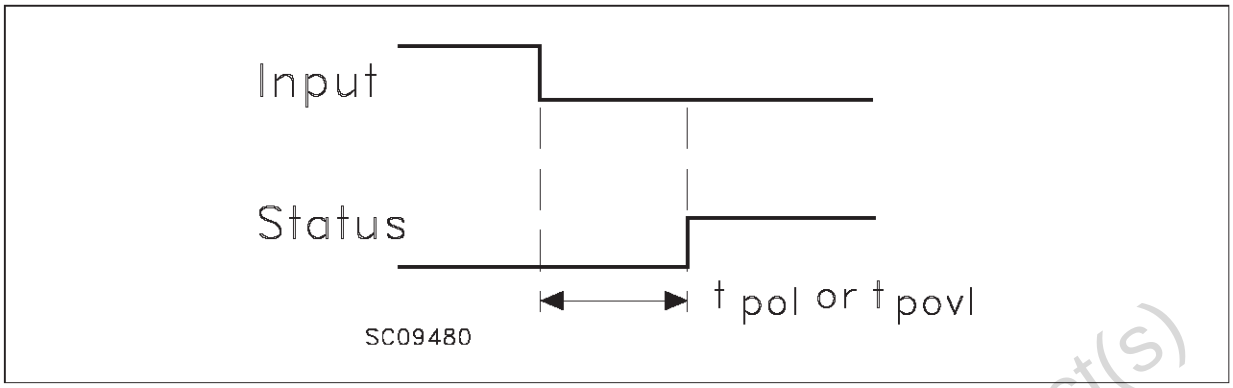
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time Of Output Current | $I_{OUT}$ = 5 A Resistive Load<br>Input Rise Time < 0.1 µs $T_j$ = 25 °C | 25 | 90 | 250 | µs |
| $t_r$ | Rise Time Of Output Current | $I_{OUT}$ = 5 A Resistive Load<br>Input Rise Time < 0.1 µs $T_j$ = 25 °C | 80 | 300 | 650 | µs |
| $t_{d(off)}$ | Turn-off Delay Time Of Output Current | $I_{OUT}$ = 5 A Resistive Load<br>Input Rise Time < 0.1 µs $T_j$ = 25 °C | 300 | 750 | 1500 | µs |
| $t_f$ | Fall Time Of Output Current | $I_{OUT}$ = 5 A Resistive Load<br>Input Rise Time < 0.1 µs $T_j$ = 25 °C | 80 | 200 | 400 | µs |
| $(di/dt)_{on}$ | Turn-on Current Slope | $I_{OUT}$ = 5 A | | 0.02 | 0.05 | A/µs |
| $(di/dt)_{off}$ | Turn-off Current Slope | $I_{OUT}$ = 5 A | | 0.02 | 0.05 | A/µs |

**ELECTRICAL CHARACTERISTICS** (continued)
PROTECTIONS AND DIAGNOSTICS

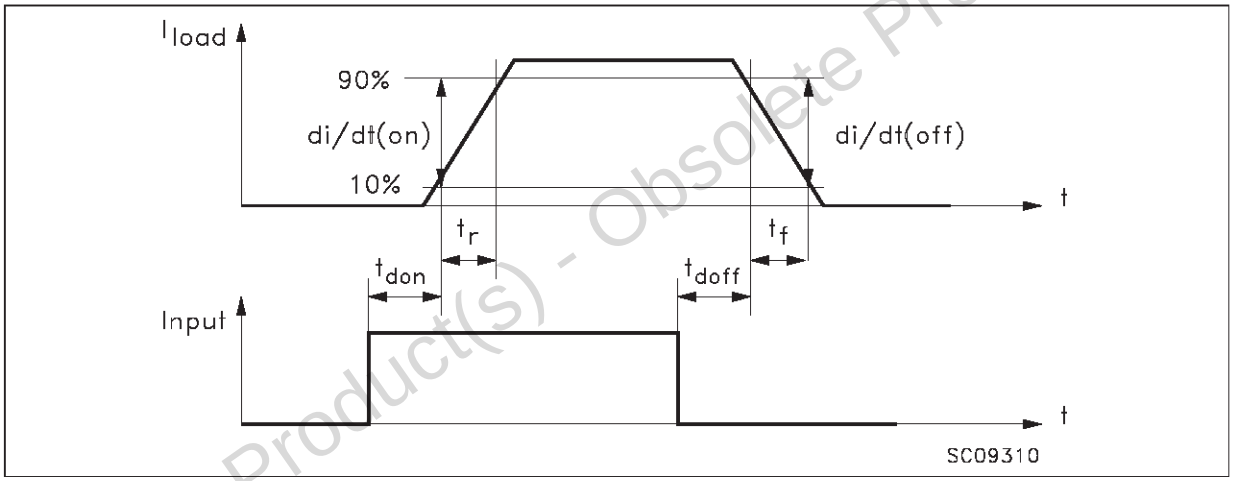
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $T_{TSD}$ | Thermal Shut-down Temperature | | 150 | 170 | 190 | °C |
| $T_{TR}$ | Thermal Reset Temperature | | 135 | | | °C |
| $T_{RSD}$ (HYST) | Thermal Hysteresis | | 5 | 15 | 50 | °C |
| $V_{ENOL}$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

(*) ISO definitions $T_{POL}$ = Status delay in case of open load conditions
$T_{POVL}$ = Status delay in case of over load conditions

**FIGURE 1**




**SWITCHING PARAMETERS TEST CONDITIONS**

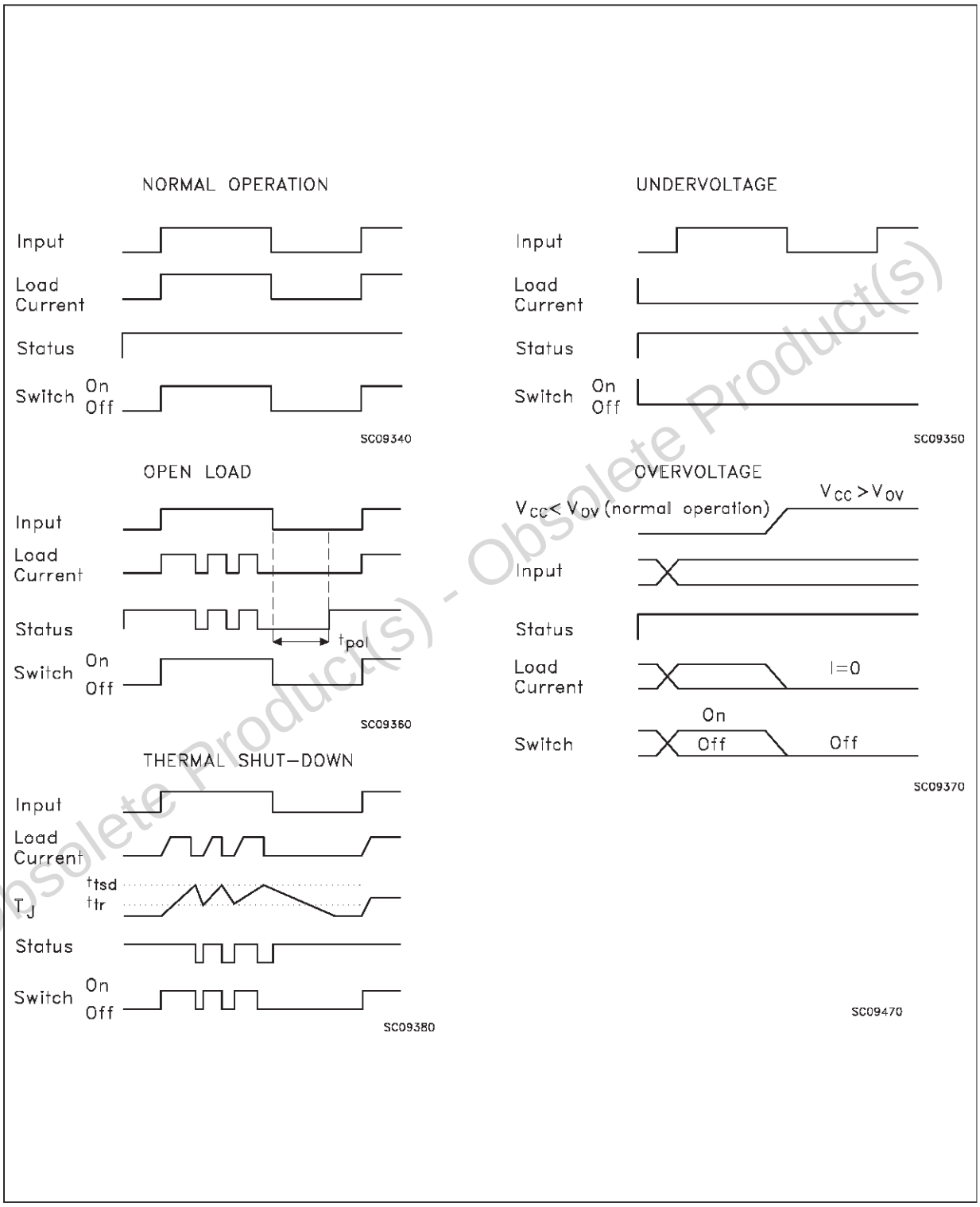



**TRUTH TABLE**

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

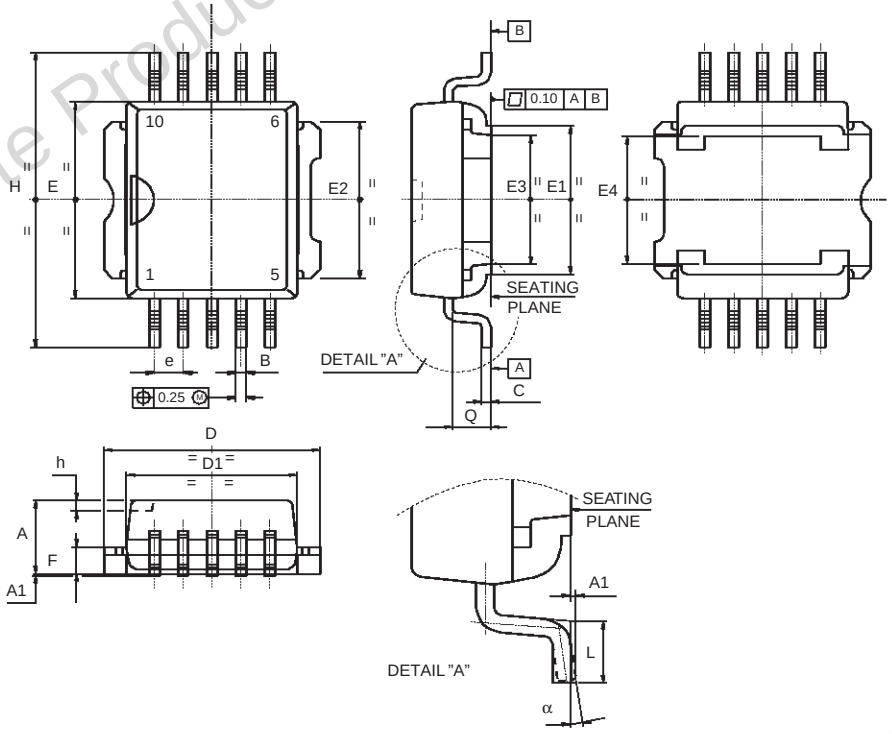
H = high level, L= low level, X= unspecified

**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 | |
| α | $0^o$ | | $8^o$ | | | |

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