



**VN340SP**

## QUAD HIGH SIDE SMART POWER SOLID STATE RELAY

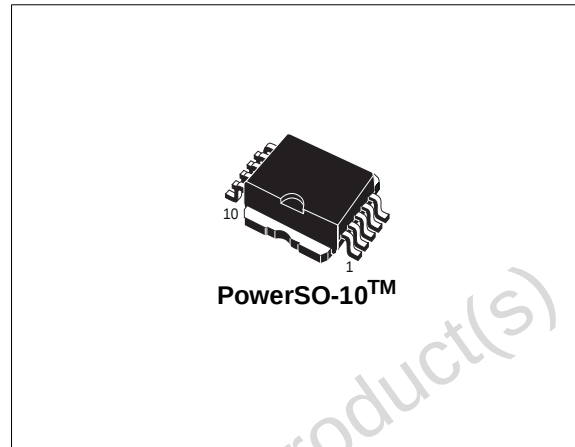
| TYPE    | $V_{\text{demag}}^{(*)}$   | $R_{\text{DSon}}^{(*)}$ | $I_{\text{out}}^{(*)}$ | $V_{\text{CC}}$ |
|---------|----------------------------|-------------------------|------------------------|-----------------|
| VN340SP | $V_{\text{CC}}-55\text{V}$ | $0.2\Omega$             | $0.7\text{A}$          | $36\text{V}$    |

(\*) Per channel

- OUTPUT CURRENT : 0.7A PER CHANNEL
- DIGITAL I/O's CLAMPED AT 32V MINIMUM VOLTAGE
- SHORTED LOAD AND OVERTEMPERATURE PROTECTIONS
- PROTECTION AGAINST LOSS OF GROUND
- BUILT-IN CURRENT LIMITER
- UNDERVOLTAGE SHUT-DOWN
- OPEN DRAIN DIAGNOSTIC OUTPUT
- FAST DEMAGNETIZATION OF INDUCTIVE LOADS
- CONFORMS TO IEC 1131-2

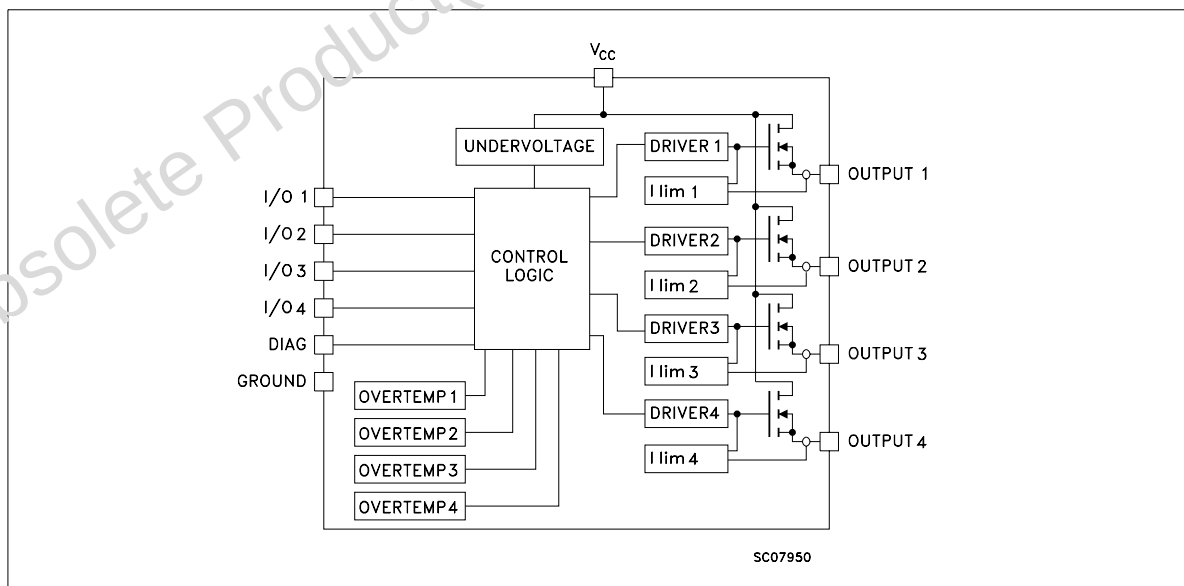
### DESCRIPTION

The VN340SP is a monolithic device made using STMicroelectronics VIPower technology, intended for driving four independent resistive or inductive loads with one side connected to ground. Active current limitation avoids dropping the system



power supply in case of shorted load. Built-in thermal shut-down protects the chip from overtemperature and short circuit. The open drain diagnostic output indicates overtemperature conditions. Each I/O is pulled down when overtemperature condition of the relative channel is verified.

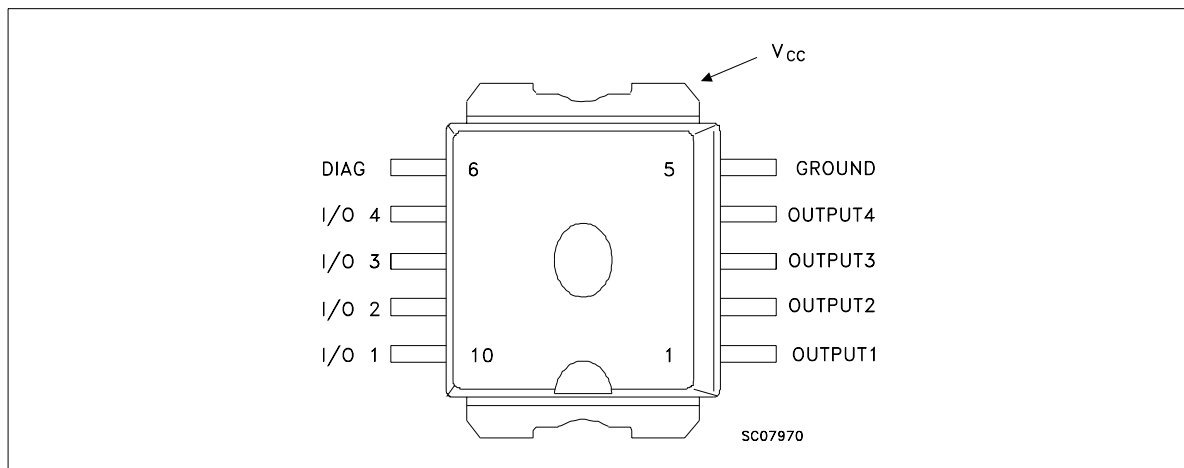
### BLOCK DIAGRAM



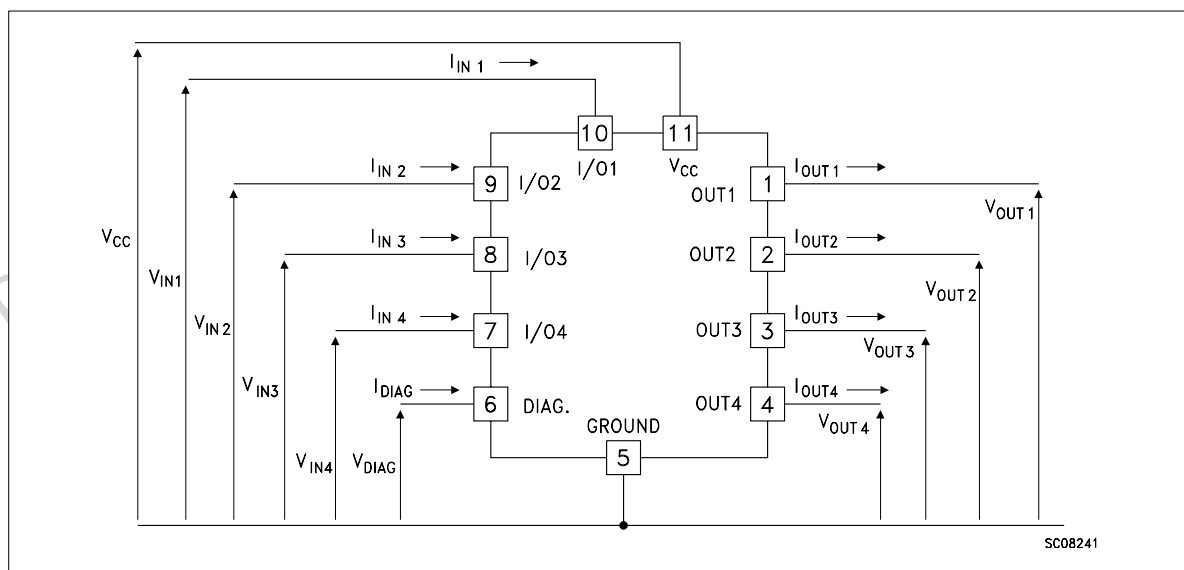
## ABSOLUTE MAXIMUM RATING

| Symbol     | Parameter                                                                   | Value              | Unit       |
|------------|-----------------------------------------------------------------------------|--------------------|------------|
| $V_{CC}$   | Power supply voltage                                                        | 45                 | V          |
| $-V_{CC}$  | Reverse supply voltage                                                      | -4                 | V          |
| $I_{OUT}$  | Output current (continuous)                                                 | Internally limited | A          |
| $I_R$      | Reverse output current (per channel)                                        | -6                 | A          |
| $I_{IN}$   | Input current (per channel)                                                 | $\pm 10$           | mA         |
| $I_{DIAG}$ | Diag pin current                                                            | $\pm 10$           | mA         |
| $V_{ESD}$  | Electrostatic discharge ( $R=1.5K\Omega$ ; $C=100pF$ )                      | 2000               | V          |
| $E_{AS}$   | Single pulse avalanche energy per channel not simultaneously (see figure 1) | 400                | mJ         |
| $P_{tot}$  | Power dissipation at $T_c=25^\circ C$                                       | Internally limited | W          |
| $T_j$      | Junction operating temperature                                              | Internally limited | $^\circ C$ |
| $T_{stg}$  | Storage temperature                                                         | -55 to 150         | $^\circ C$ |

## CONNECTION DIAGRAM TOP VIEW



## CURRENT AND VOLTAGE CONVENTIONS



## THERMAL DATA

| Symbol         | Parameter                                     | Value | Unit |
|----------------|-----------------------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case (1) (MAX)    | 3     | °C/W |
| $R_{thj-amb}$  | Thermal resistance junction-ambient (§) (MAX) | 50    | °C/W |

(1) Per channel

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

ELECTRICAL CHARACTERISTICS (10V <  $V_{CC}$  < 36V; -25°C <  $T_j$  < 85°C; unless otherwise specified)

## POWER

| Symbol      | Parameter                  | Test Conditions                                                                                                  | Min         | Typ         | Max                | Unit                             |
|-------------|----------------------------|------------------------------------------------------------------------------------------------------------------|-------------|-------------|--------------------|----------------------------------|
| $V_{CC}$    | Supply voltage             |                                                                                                                  | 10          |             | 36                 | V                                |
| $R_{ON}$    | On state resistance        | $I_{OUT}=0.5A$ ; $T_j=25^\circ C$<br>$I_{OUT}=0.5A$ ; -25°C < $T_j$ < 85°C<br>$I_{OUT}=0.5A$ ; $T_j=125^\circ C$ |             |             | 0.2<br>0.32<br>0.4 | $\Omega$<br>$\Omega$<br>$\Omega$ |
| $I_S$       | Supply current             | All channels off<br>On state; $V_{IN}=30V$ ; $I_{OUTn}=0V$<br>( $T_j=125^\circ C$ )                              |             |             | 1<br>6             | mA<br>mA                         |
| $V_{OL}$    | Low state output voltage   | $V_{IN}=V_{IL}$ ; $R_{LOAD} \geq 10M\Omega$                                                                      |             |             | 1.5                | V                                |
| $V_{demag}$ | Output voltage at turn-off | $I_{OUT}=0.5A$ ; $L_{LOAD}=1mH$                                                                                  | $V_{CC}-65$ | $V_{CC}-55$ | $V_{CC}-45$        | V                                |
| $I_{LGND}$  | Output current at turn-off | $V_{CC}=V_{INn}=V_{GND}=V_{STAT}=18$ to 30V<br>$T_{amb}=-25^\circ C$ to 85°C (*)                                 |             |             | 2                  | mA                               |

(\*) see test configuration and application description

SWITCHING ( $V_{CC}=24V$ )

| Symbol       | Parameter                             | Test Conditions                                                                     | Min | Typ | Max | Unit    |
|--------------|---------------------------------------|-------------------------------------------------------------------------------------|-----|-----|-----|---------|
| $t_{d(on)}$  | Turn-on delay time of Output current  | $I_{OUT}=0.5A$ , Resistive Load<br>Input rise time < 0.1 $\mu s$ , $T_j=25^\circ C$ |     | 52  | 100 | $\mu s$ |
| $t_r$        | Rise time of Output current           | $I_{OUT}=0.5A$ , Resistive Load<br>Input rise time < 0.1 $\mu s$ , $T_j=25^\circ C$ |     | 94  | 250 | $\mu s$ |
| $t_{d(off)}$ | Turn-off delay time of Output current | $I_{OUT}=0.5A$ , Resistive Load<br>Input rise time < 0.1 $\mu s$ , $T_j=25^\circ C$ |     | 34  | 50  | $\mu s$ |
| $t_f$        | Fall time of Output current           | $I_{OUT}=0.5A$ , Resistive Load<br>Input rise time < 0.1 $\mu s$ , $T_j=25^\circ C$ |     | 8   | 20  | $\mu s$ |

**ELECTRICAL CHARACTERISTICS** (continued)**LOGIC INPUT** (Per each channel)

| Symbol        | Parameter                                    | Test Conditions               | Min | Typ        | Max | Unit    |
|---------------|----------------------------------------------|-------------------------------|-----|------------|-----|---------|
| $V_{IL}$      | I/O Input low level voltage                  |                               |     |            | 2   | V       |
| $V_{IH}$      | I/O Input high level voltage<br>(see note 1) |                               | 3.5 |            |     | V       |
| $V_{I(HYST)}$ | I/O Input hysteresis voltage                 |                               |     | 0.5        |     | V       |
| $I_{IN}$      | I/O Input current                            | $V_{IN}=30V$                  |     |            | 25  | $\mu A$ |
| $V_{ICL}$     | I/O Input clamp voltage<br>(see note 1)      | $I_{IN}=1mA$<br>$I_{IN}=-1mA$ | 32  | 36<br>-0.7 |     | V<br>V  |

Note 1 : The input voltage is internally clamped at 32V minimum , it is possible to connect the input pins to an higher voltage via an external resistor calculate to not exceed 10mA.

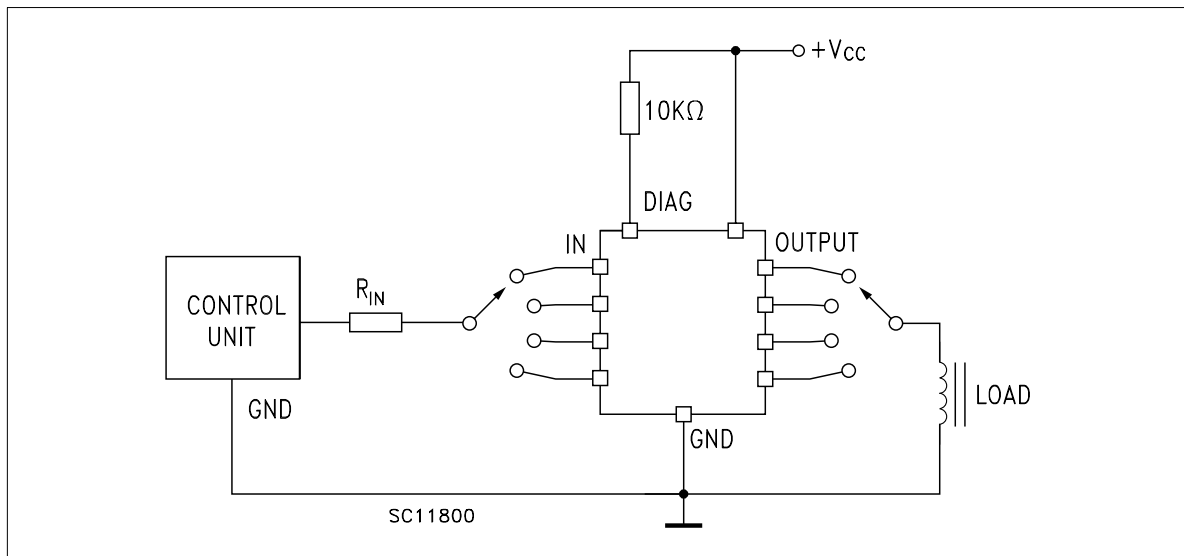
**PROTECTION AND DIAGNOSTICS**

| Symbol         | Parameter                         | Test Conditions                                                      | Min | Typ        | Max | Unit        |
|----------------|-----------------------------------|----------------------------------------------------------------------|-----|------------|-----|-------------|
| $V_{DIAG} (*)$ | Status voltage output low         | $I_{STAT}=5mA$<br>(Fault condition)                                  |     |            | 1   | V           |
| $V_{SCL} (*)$  | Status clamp voltage              | $I_{DIAG}=1mA$<br>$I_{DIAG}=-1mA$                                    | 32  | 36<br>-0.7 |     | V<br>V      |
| $V_{USD}$      | Undervoltage shut down            |                                                                      | 5   |            | 8   | V           |
| $I_{LIM}$      | DC Short circuit current          | $V_{CC}=24V$ ; $R_{LOAD}<10m\Omega$                                  | 0.7 |            | 2   | A           |
| $I_{OVPK}$     | Peak short circuit current        | $V_{CC}=24V$ ; $V_{IN}=30V$ ; $R_{LOAD}<10m\Omega$<br>(see figure 2) |     |            | 4   | A           |
| $I_{DIAGH}$    | Leakage on diag pin in high state | $V_{DIAG}=24V$                                                       |     |            | 25  | $\mu A$     |
| $I_{LOAD}$     | Output leakage current            | $V_{CC}=10$ to $36V$ ; $V_{IN}=V_{IL}$                               |     |            | 50  | $\mu A$     |
| $t_{SC}$       | Delay time of current limiter     |                                                                      |     |            | 100 | $\mu s$     |
| $T_{TSD}$      | Thermal shut down temperature     |                                                                      | 150 | 170        |     | $^{\circ}C$ |
| $T_R$          | Thermal reset temperature         |                                                                      | 135 | 155        |     | $^{\circ}C$ |

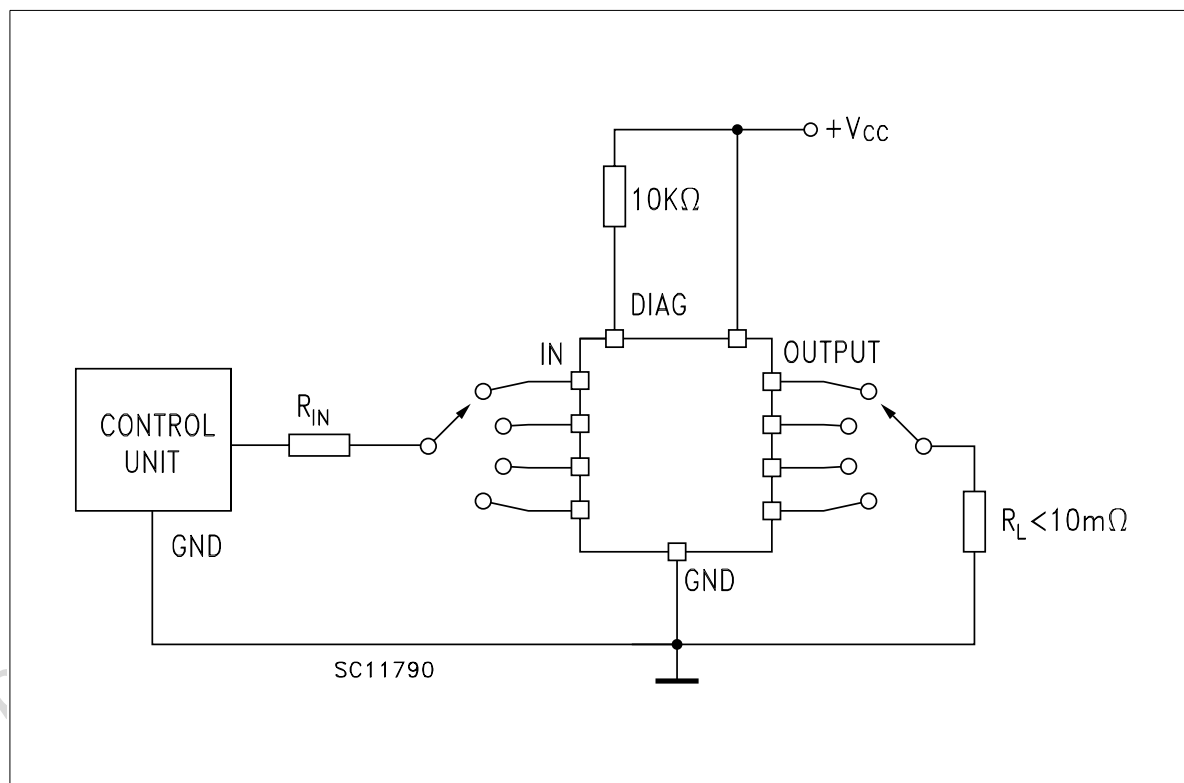
(\*) Status determination > 100 $\mu s$  after the switching edge.

Note: If INPUT pin is floating the corresponding channel will automatically switch off. If GND pin is disconnected, the channel will switch off provided  $V_{CC}$  not exceed 36V.

**FIGURE 1:** Avalanche Energy Test Circuit

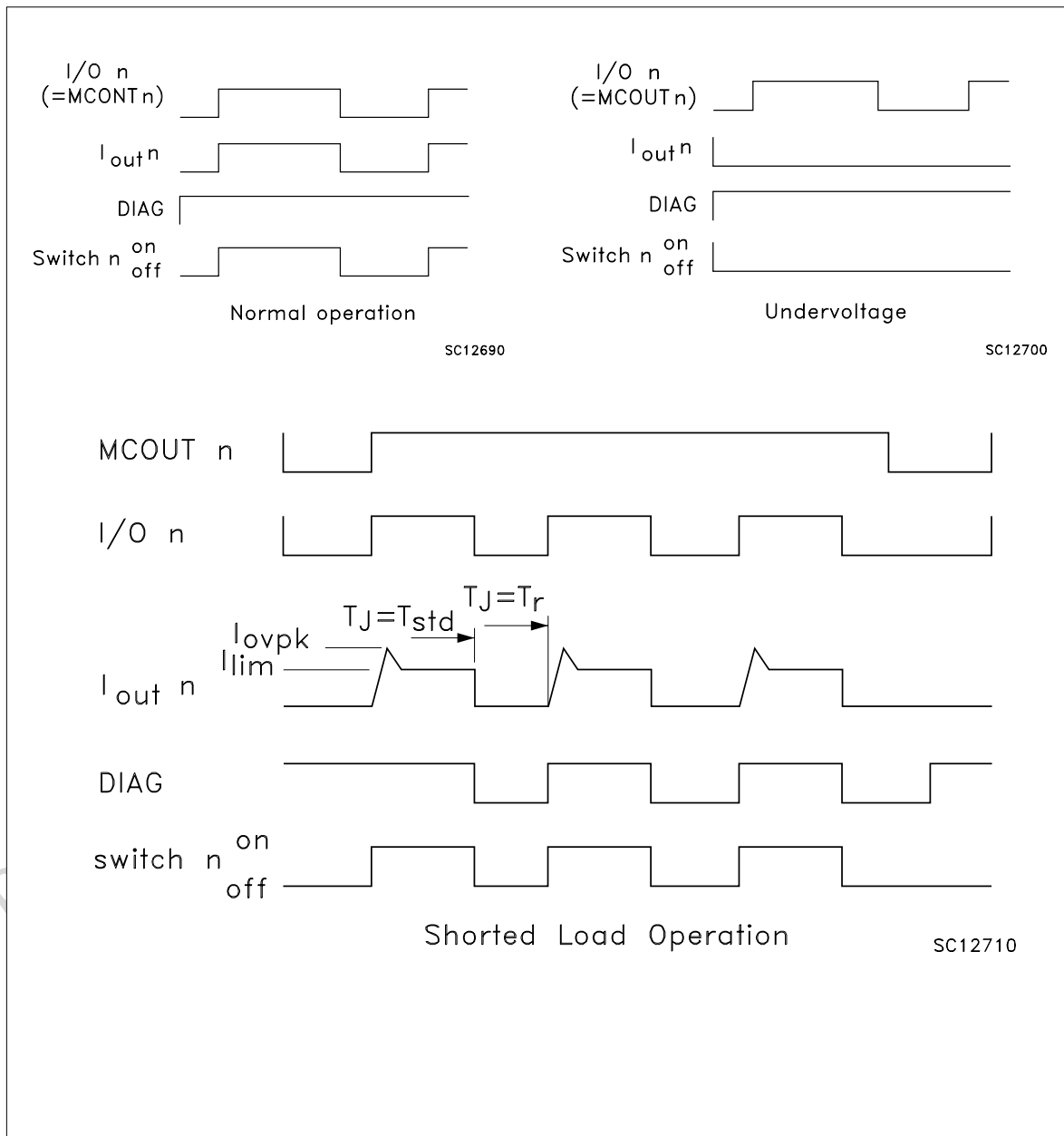


**FIGURE 2:** Peak Short Circuit Current Test Circuit

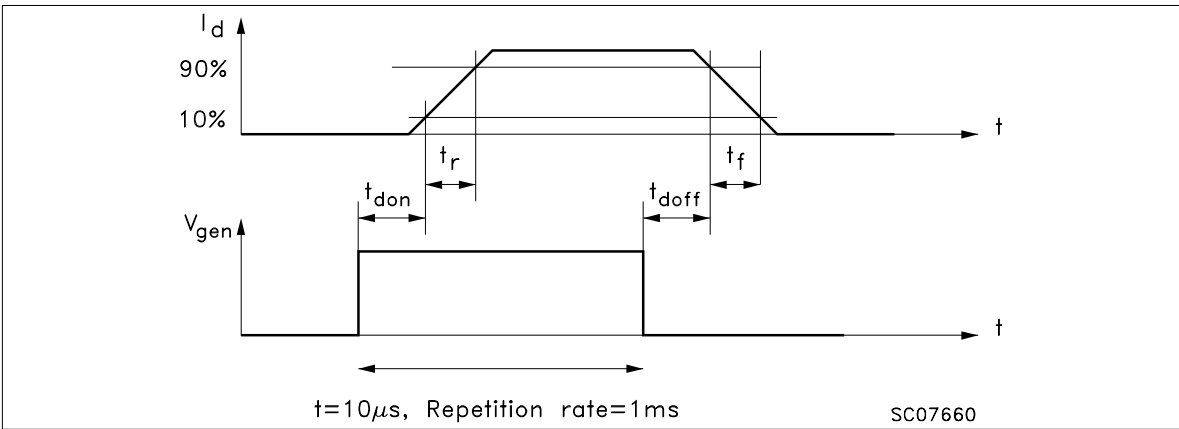


**THRUTH TABLE**

|                                      | MCOUTn | I/On   | OUTPUTn | DIAGNOSTIC |
|--------------------------------------|--------|--------|---------|------------|
| Normal operation                     | L<br>H | L<br>H | L<br>H  | H<br>H     |
| Overtemperature                      | L<br>H | L<br>L | L<br>L  | H<br>L     |
| Undervoltage                         | L<br>H | L<br>H | L<br>L  | H<br>H     |
| Shorted load<br>(Current limitation) | L<br>H | L<br>H | L<br>H  | H<br>H     |

**Figure 3: Switching Waveforms**

SWITCHING PARAMETERS TEST CONDITIONS



DRIVING CIRCUIT

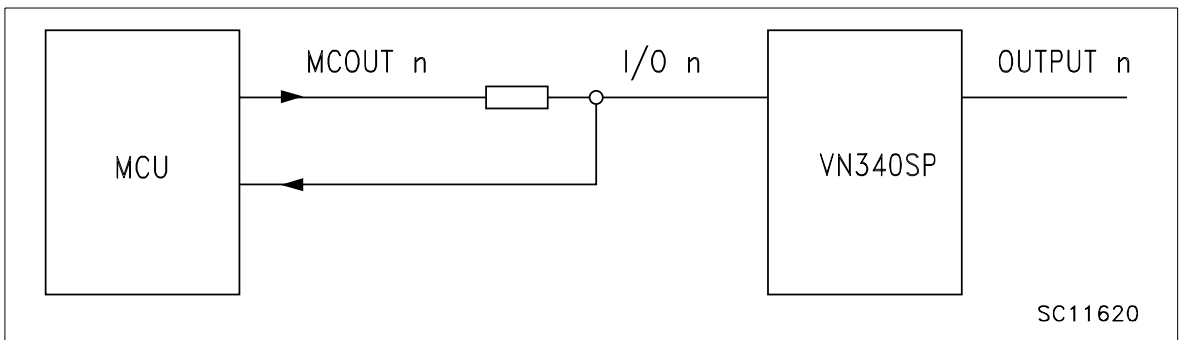
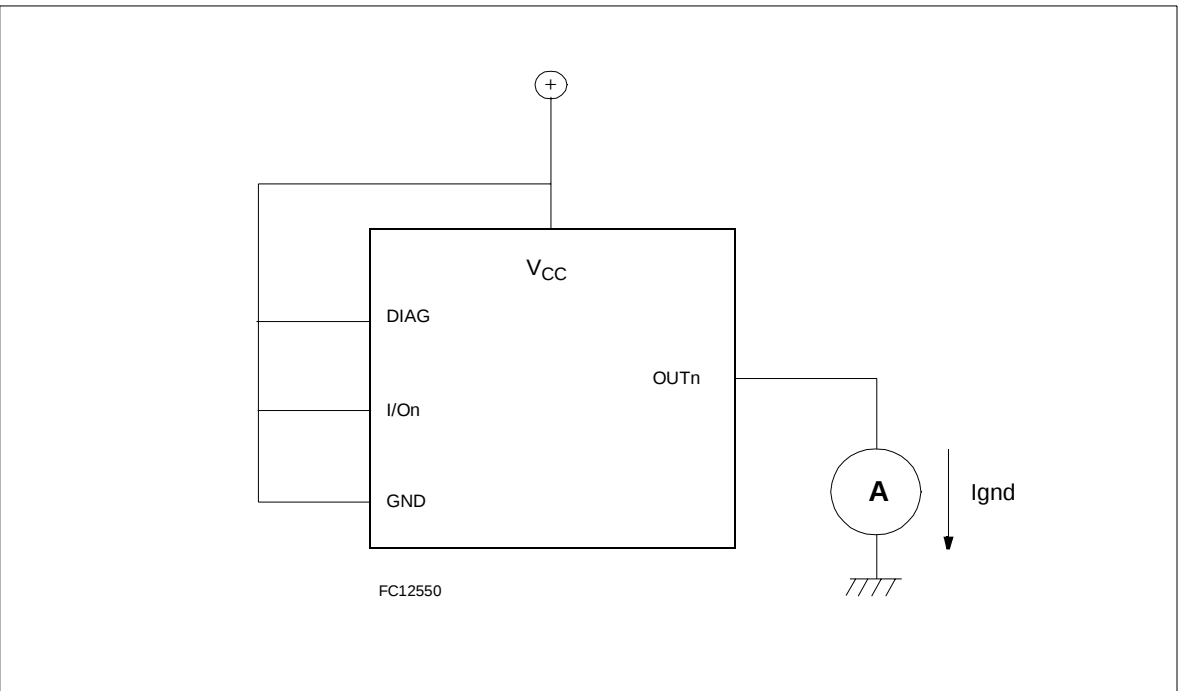


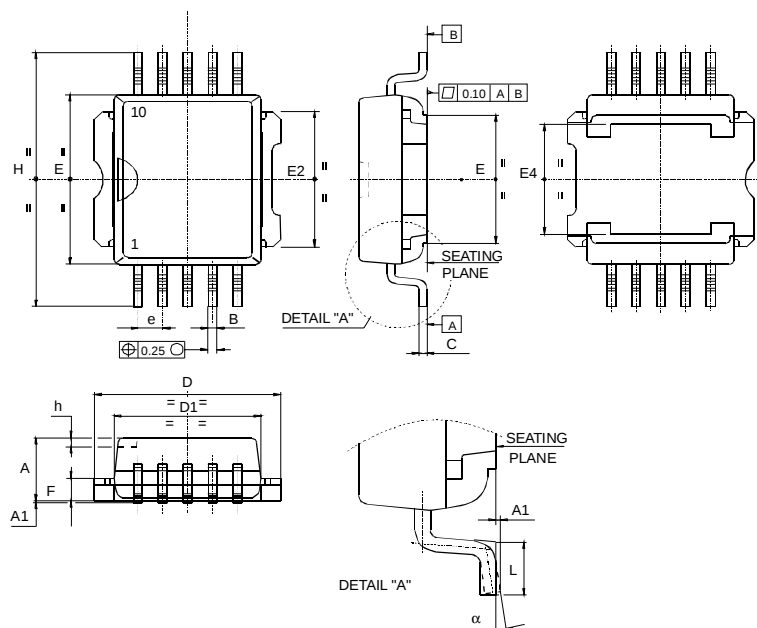
Fig. 4:  $I_{LGND}$  Test Configuration



## PowerSO-10™ MECHANICAL DATA

| DIM.         | mm.   |      |       | inch  |       |        |
|--------------|-------|------|-------|-------|-------|--------|
|              | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.   |
| A            | 3.35  |      | 3.65  | 0.132 |       | 0.144  |
| A (*)        | 3.4   |      | 3.6   | 0.134 |       | 0.142  |
| A1           | 0.00  |      | 0.10  | 0.000 |       | 0.004  |
| B            | 0.40  |      | 0.60  | 0.016 |       | 0.024  |
| B (*)        | 0.37  |      | 0.53  | 0.014 |       | 0.021  |
| C            | 0.35  |      | 0.55  | 0.013 |       | 0.022  |
| C (*)        | 0.23  |      | 0.32  | 0.009 |       | 0.0126 |
| 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  |
| E2           | 7.20  |      | 7.60  | 0.283 |       | 300    |
| E2 (*)       | 7.30  |      | 7.50  | 0.287 |       | 0.295  |
| E4           | 5.90  |      | 6.10  | 0.232 |       | 0.240  |
| E4 (*)       | 5.90  |      | 6.30  | 0.232 |       | 0.248  |
| e            |       | 1.27 |       |       | 0.050 |        |
| F            | 1.25  |      | 1.35  | 0.049 |       | 0.053  |
| F (*)        | 1.20  |      | 1.40  | 0.047 |       | 0.055  |
| H            | 13.80 |      | 14.40 | 0.543 |       | 0.567  |
| H (*)        | 13.85 |      | 14.35 | 0.545 |       | 0.565  |
| h            |       | 0.50 |       |       | 0.002 |        |
| L            | 1.20  |      | 1.80  | 0.047 |       | 0.070  |
| L (*)        | 0.80  |      | 1.10  | 0.031 |       | 0.043  |
| $\alpha$     | 0°    |      | 8°    | 0°    |       | 8°     |
| $\alpha$ (*) | 2°    |      | 8°    | 2°    |       | 8°     |

(\*) Muar only POA P013P



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