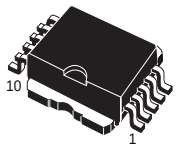
VN340SP

QUAD HIGH SIDE SMART POWER SOLID STATE RELAY

TYPE	V_{demag}(*)	R_{DSon} (*)	I_{out} (*)	V_{cc}
VN340SP	Vcc-55V	0.2Ω	0.7A	36 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

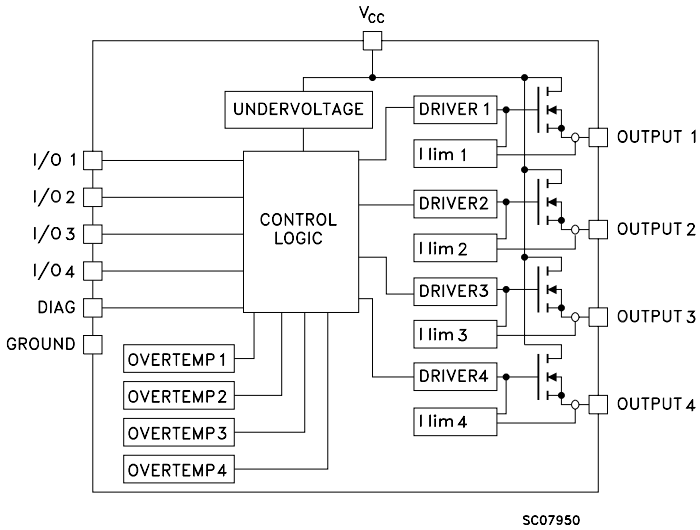


PowerSO-10™

DESCRIPTION

The VN340SP is a monolithic device made using STMicroelectronics VIPower technology, intended for driving four indipendent 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.

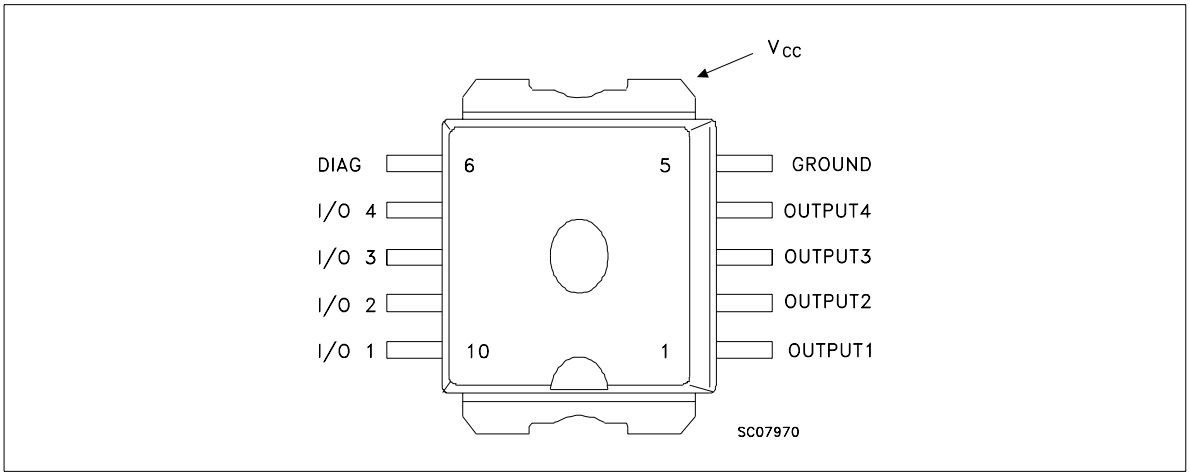
BLOCK DIAGRAM



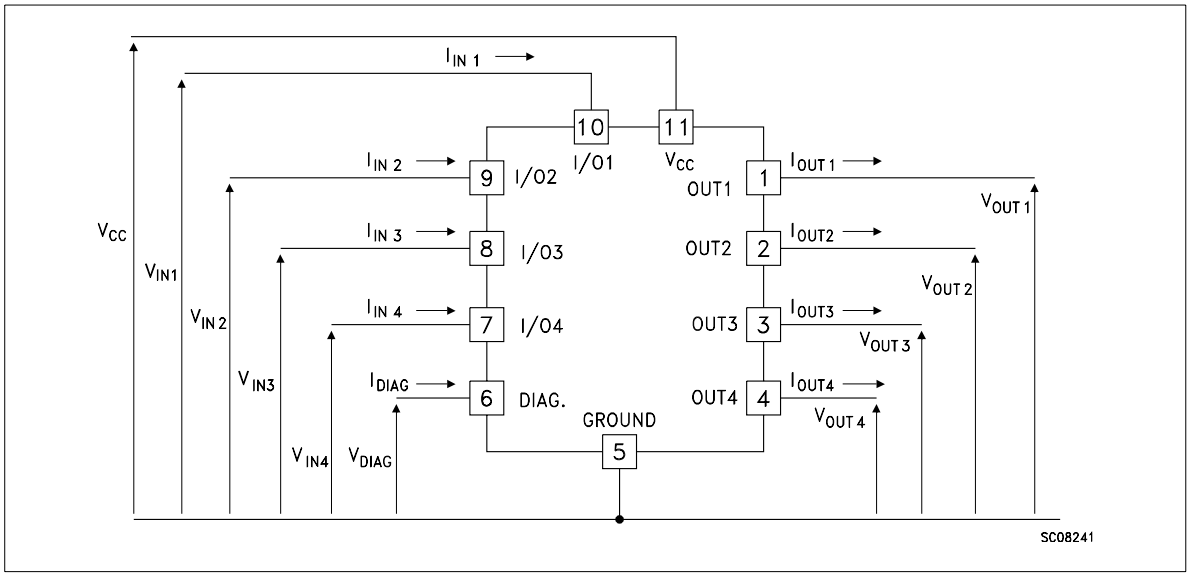
ABSOLUTE MAXIMUM RATING

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)	± 10	mA
I_{DIAG}	Diag pin current	±10	mA
V_{ESD}	Electrostatic discharge (R=1.5KΩ; 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°C	Internally limited	W
T_j	Junction operating temperature	Internally limited	°C
T_{stg}	Storage temperature	-55 to 150	°C

CONNECTION DIAGRAM TOP VIEW



CURRENT AND VOLTAGE CONVENTIONS



THERMAL DATA

Symbol	Parameter		Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case (1)	(MAX)	3	°C/W
$R_{thj\text{-}amb}$	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°C			0.2	Ω
		I_{OUT}=0.5A; -25°C<T_j<85°C			0.32	Ω
		I_{OUT}=0.5A; T_j=125°C			0.4	Ω
I_S	Supply current	All channels off			1	mA
		On state; V_{IN}=30V; I_{OUTn}=0V				
		(T_j=125°C)			6	mA
V_{OL}	Low state output voltage	$V_{IN}=V_{IL}$; R_{LOAD}≥10MΩ			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			2	mA
		T_{amb}=-25°C to 85°C (*)				

(*) 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 Input rise time <0.1µs, T_j=25°C		52	100	µs
t_r	Rise time of Output current	I_{OUT}=0.5A, Resistive Load Input rise time <0.1µs, T_j=25°C		94	250	µs
$t_{d(off)}$	Turn-off delay time of Output current	I_{OUT}=0.5A, Resistive Load Input rise time <0.1µs, T_j=25°C		34	50	µs
t_f	Fall time of Output current	I_{OUT}=0.5A, Resistive Load Input rise time <0.1µs, T_j=25°C		8	20	µs

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 (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	µA
V_{ICL}	I/O Input clamp voltage (see note 1)	I_{IN}=1mA I_{IN}=-1mA	32	36 -0.7		V 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 (Fault condition)			1	V
V_{SCL}(*)	Status clamp voltage	I_{DIAG}=1mA I_{DIAG}=-1mA	32	36 -0.7		V V
V_{USD}	Undervoltage shut down		5		8	V
I_{LIM}	DC Short circuit current	V_{CC}=24V; R_{LOAD}<10mΩ	0.7		2	A
I_{OVPK}	Peak short circuit current	V_{CC}=24V; V_{IN}=30V; R_{LOAD}<10mΩ (see figure 2)			4	A
I_{DIAGH}	Leakage on diag pin in high state	V_{DIAG}=24V			25	µA
I_{LOAD}	Output leakage current	V_{CC}=10 to 36V; V_{IN}=V_{IL}			50	µA
t_{SC}	Delay time of current limiter				100	µs
T_{TSD}	Thermal shut down temperature		150	170		°C
T_R	Thermal reset temperature		135	155		°C

(*) Status determination > 100µs after the switching edge.

Note: If INPUT pin is floating the corrisponding 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

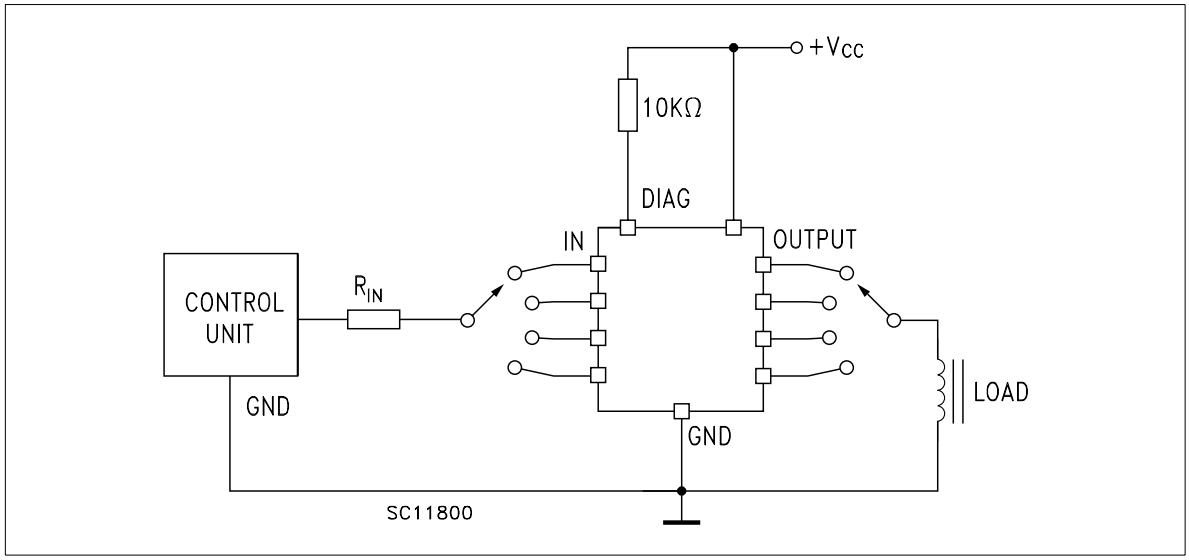
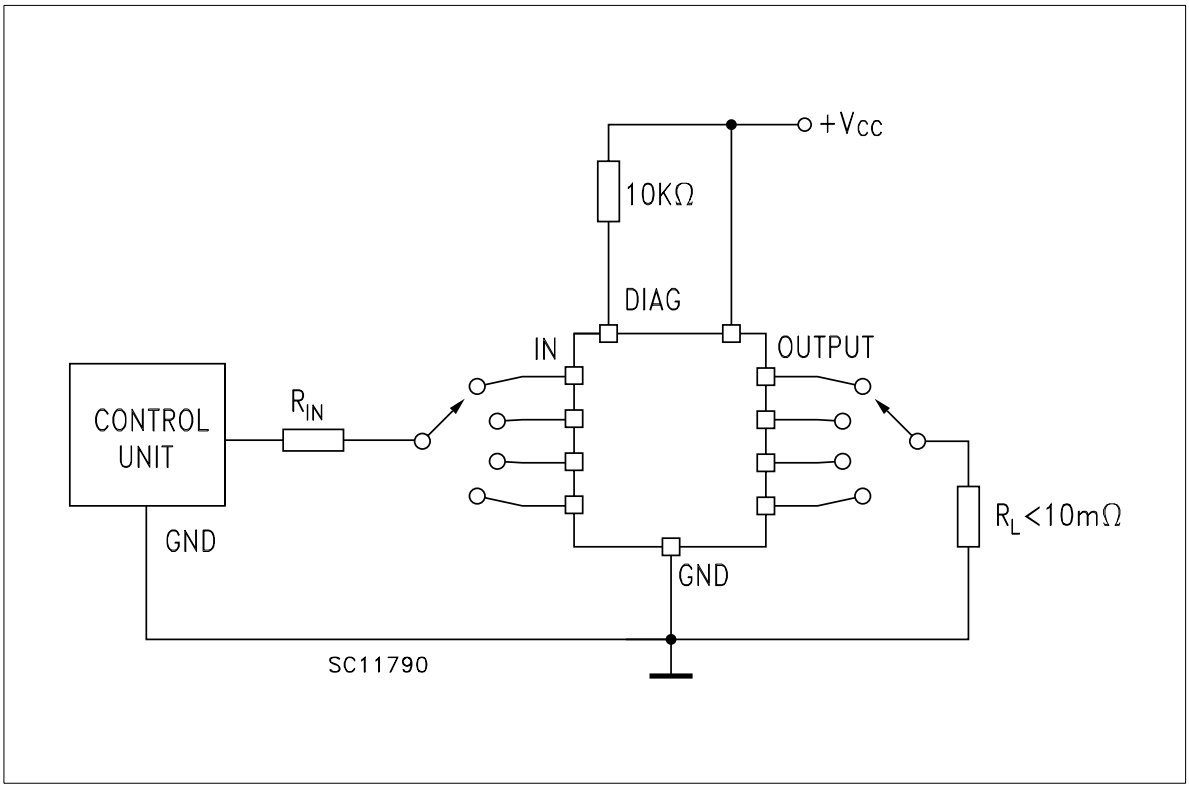


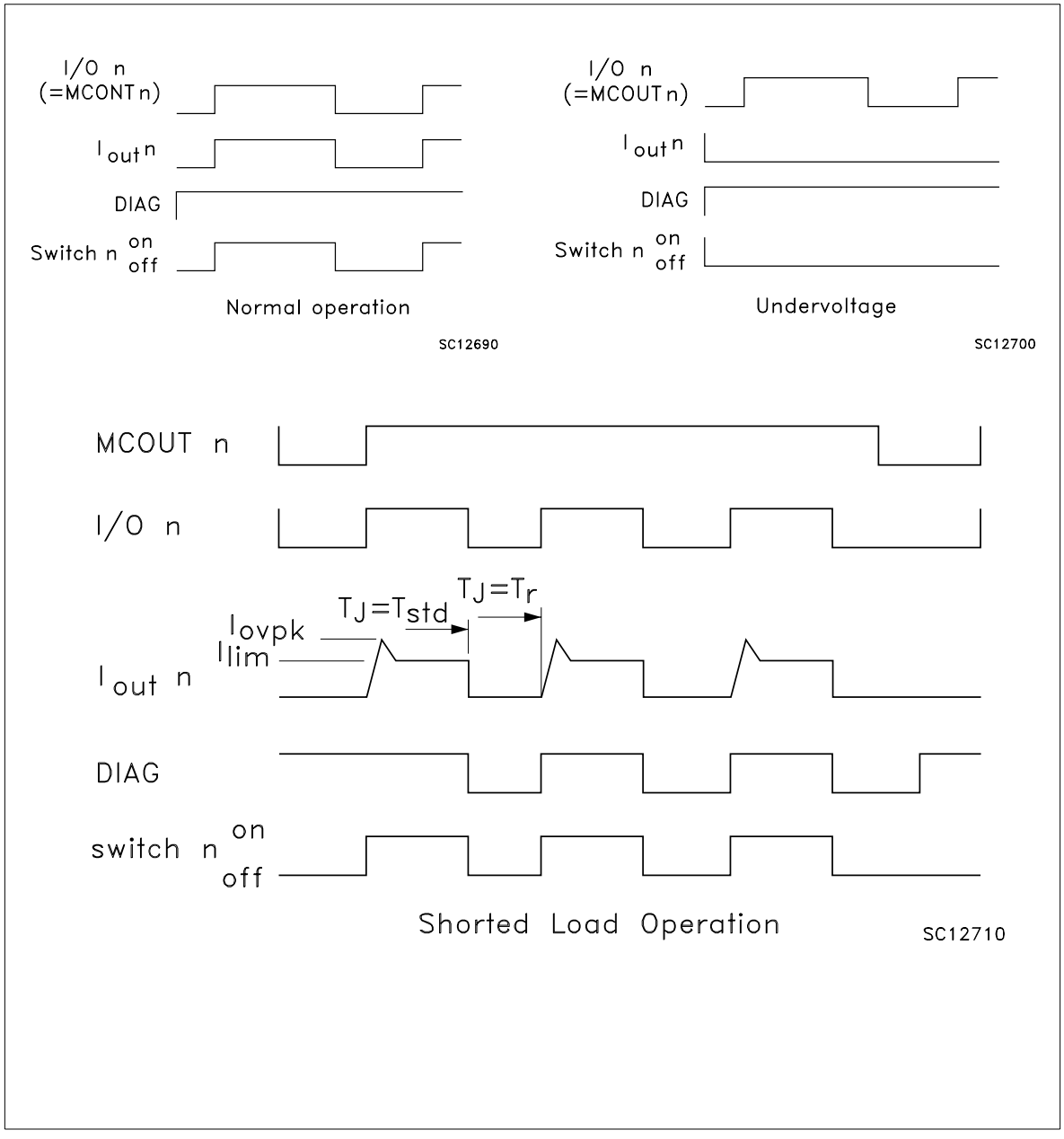
FIGURE 2: Peak Short Circuit Current Test Circuit



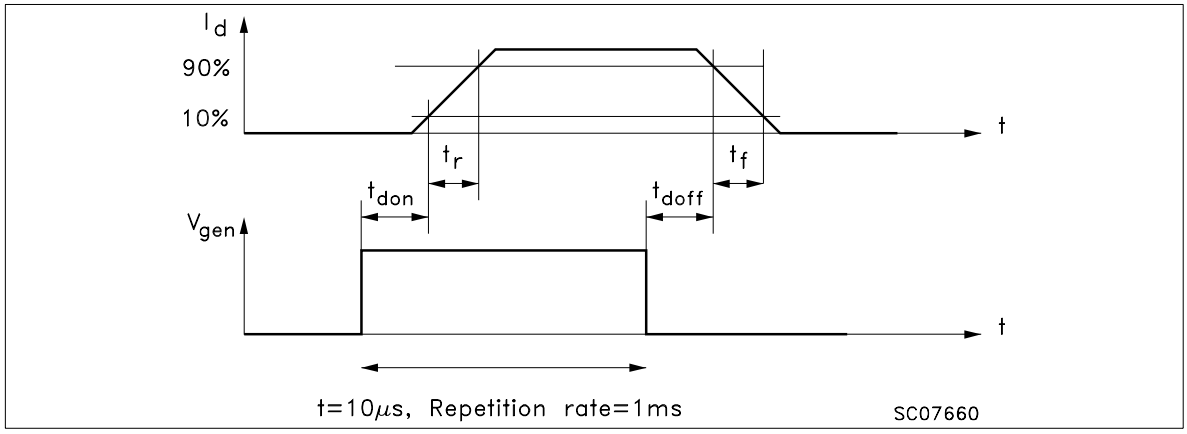
THRUTH TABLE

	MCOUTn	I/On	OUTPUTn	DIAGNOSTIC
Normal operation	L H	L H	L H	H H
Overtemperature	L H	L L	L L	H L
Undervoltage	L H	L H	L L	H H
Shorted load (Current limitation)	L H	L H	L H	H H

Figure 3: Switching Waveforms



SWITCHING PARAMETERS TEST CONDITIONS



DRIVING CIRCUIT

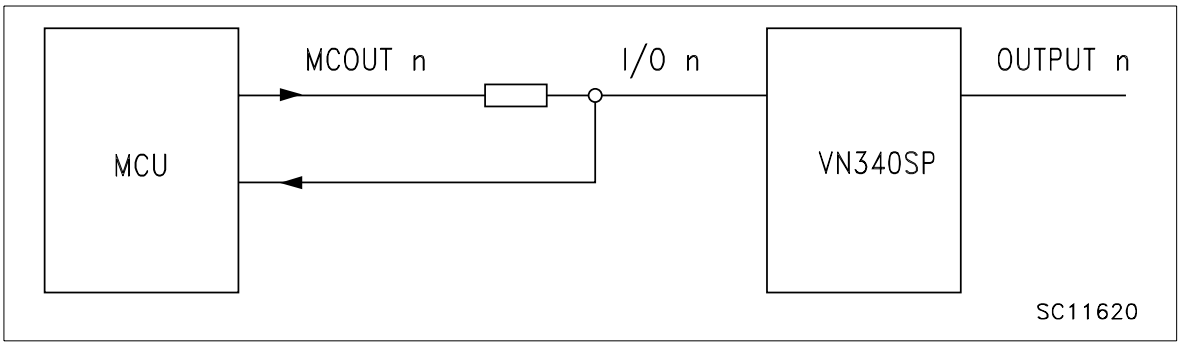
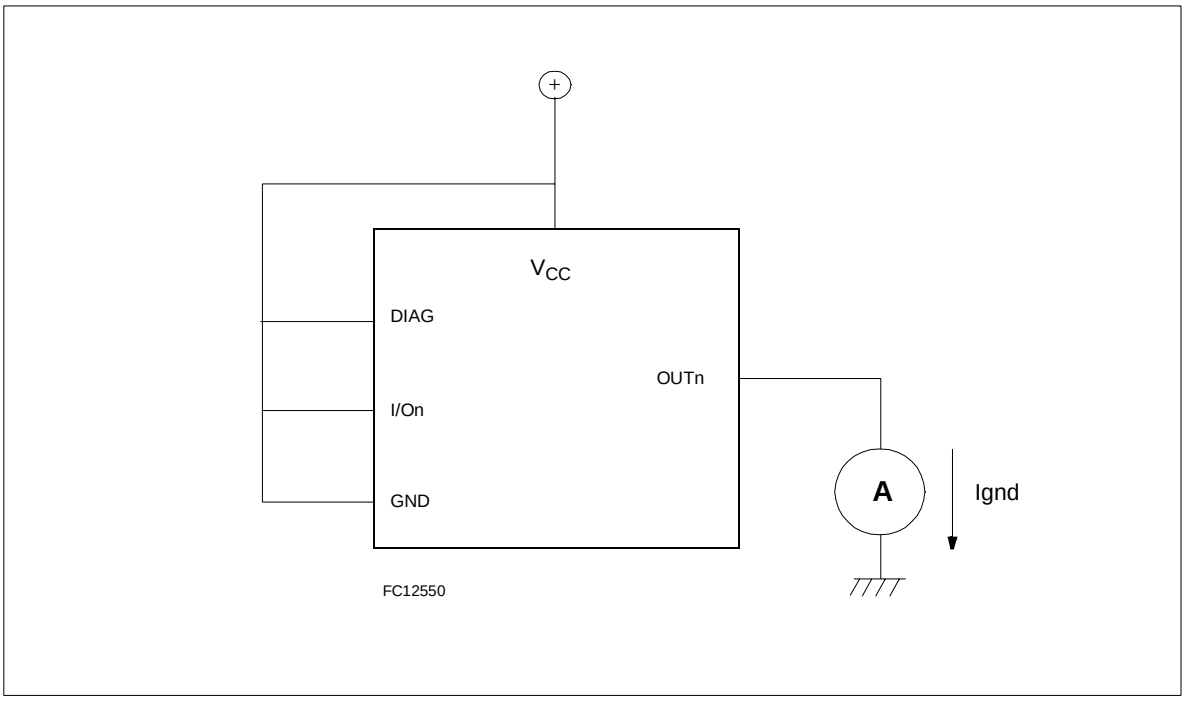


Fig. 4: I_{LGND} Test Configuration



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
α	0º		8º	0º		8º
α (*)	2º		8º	2º		8º

(*) Muar only POA P013P