VN340SP-33-E

Quad high side smart power solid state relay

Features

Type	V_{demag} (1)	$R_{DS(on)}$ (1)	I_{out} (1)	V_{CC}
VN340SP-33-E	V_{CC}-55 V	0.2 Ω	1 A	36 V

1. Per channel.

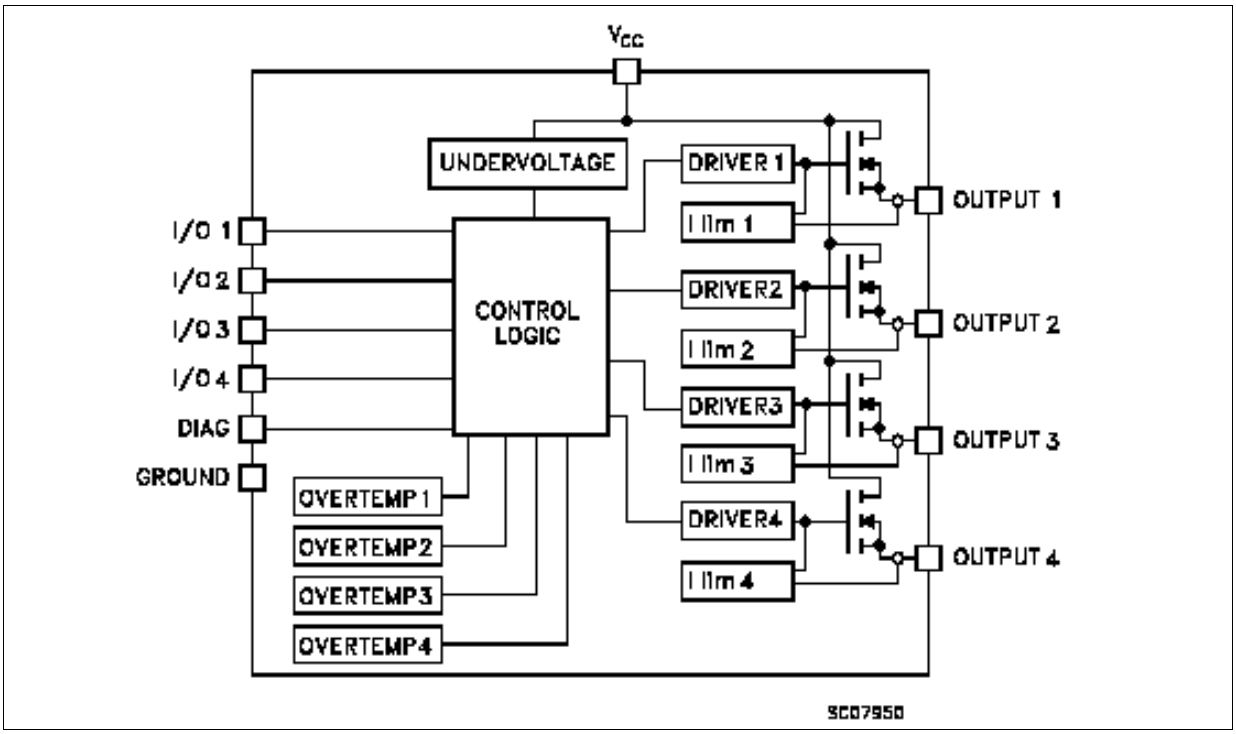
- Output current: 1 A per channel
- Digital I/O's clamped at 32 V minimum voltage
- Shorted load and overtemperature protections
- Protection against loss of ground
- Built-in current limiter
- Undervoltage shut-down
- Open drain diagnostic output
- Fast demagnetization of inductive loads
- Conforms to IEC 61131-2

PowerSO-10™

Description

The VN340SP-33-E 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.

Figure 1. Block diagram



Contents

1 Maximum ratings

Table 1. Absolute maximum rating

Symbol	Parameter	Values	Unit
V_{CC}	Power supply voltage	45	V
$-V_{CC}$	Reverse supply voltage	-4	V
I_{OUT}	Output current (continuos)	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 = 1.5 kΩ; C = 100 pF)	2000	V
E_{AS}	Single pulse avalanche energy per channel not simultaneously *Figure 4.*	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

Table 2. Thermal data

Symbol	Parameter		Values	Unit
R_{thJC}	Thermal resistance junction-case (1)	Max	3	°C/W
R_{thJA}	Thermal resistance junction-ambient (2)	Max	50	°C/W

1. Per channel
2. When mounted using minimum recommended pad size on FR-4 board

2 Pin connections

Figure 2. Connection diagram (top view)

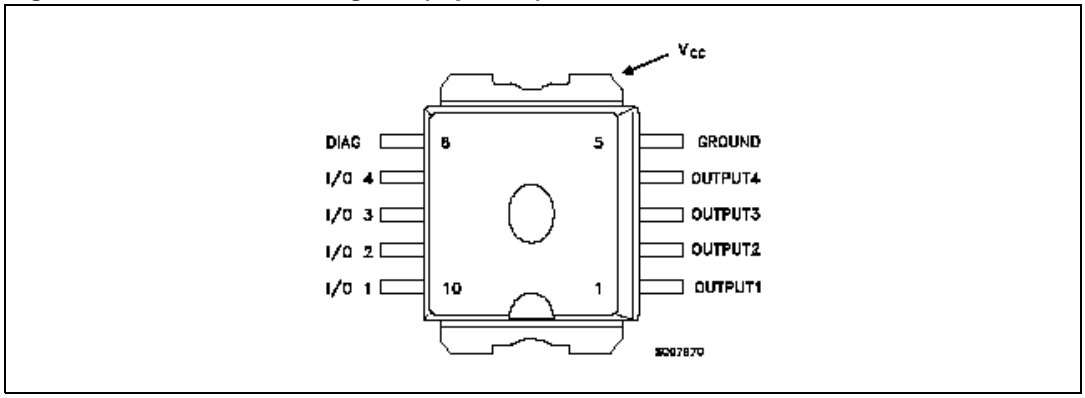
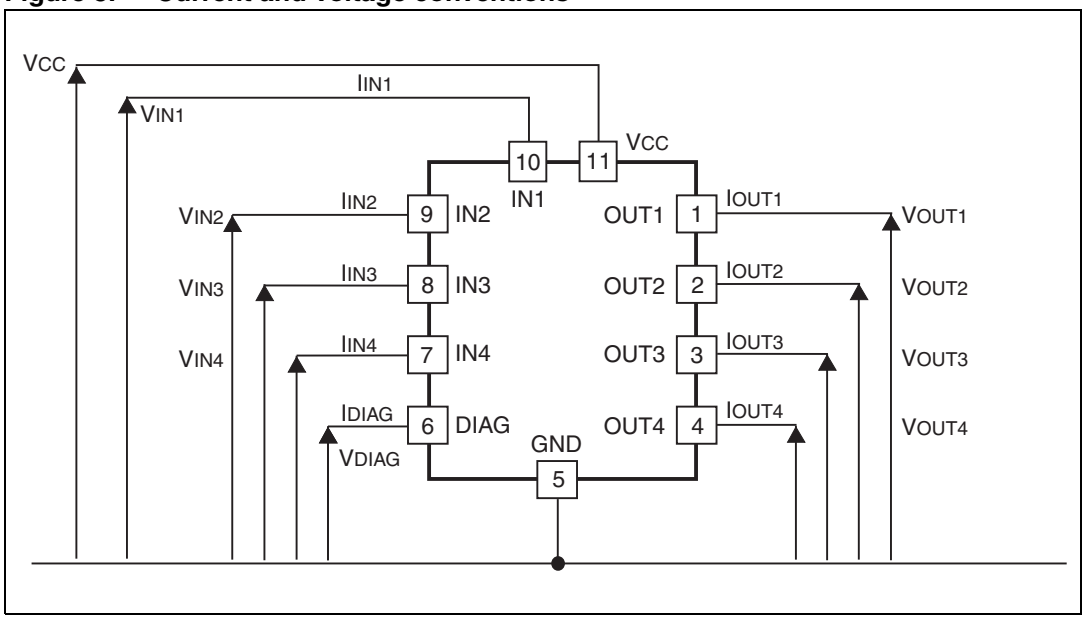


Figure 3. Current and voltage conventions



3 Electrical characteristics

10 V < V_{CC} < 36 V; -40 °C < T_J < 125 °C; unless otherwise specified

Table 3. Power section

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{CC}	Supply voltage		10		36	V
R_{ON}	On state resistance	I_{OUT} = 0.5 A; T_J = 25 °C I_{OUT} = 0.5 A; T_J = 85 °C I_{OUT} = 0.5 A; T_J = 125 °C			0.2 0.32 0.4	Ω Ω Ω
I_S	Supply current	All channels OFF On state; V_{IN} = 30 V; I_{OUT} = 0 V (T_J = 125 °C)			1 6	mA mA
V_{OL}	Low state output voltage	V_{IN} = V_{IL}; R_{LOAD} >= 10 MΩ			1.5	V
V_{demag}	Output voltage at turn-off	I_{OUT} = 0.5 A; L_{LOAD} >= 1 mH	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 30 V T_A = - 25 °C to 85 °C *Figure 6.*			2	mA

Table 4. Switching (V_{CC} = 24 V)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(ON)}$	Turn-on delay time of Output current	I_{OUT} = 0.5 A, resistive load input rise time < 0.1 µs, T_J = 25 °C		52	100	µs
t_r	Rise time of output current	I_{OUT} = 0.5 A, resistive load input rise time < 0.1 µs, T_J = 25 °C		94	250	µs
$t_{d(OFF)}$	Turn-off delay time of output current	I_{OUT} = 0.5 A, resistive load input rise time < 0.1 µs, T_J = 25 °C		34	50	µs
t_f	Fall time of output current	I_{OUT} = 0.5 A, resistive load input rise time < 0.1 µs, T_J = 25 °C		8	20	µs

Table 5. Logical input

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 (1)		3.5			V
$V_{I(HYST)}$	I/O input hysteresis voltage			0.5		V
I_{IN}	I/O input current	V_{IN} = 30 V			25	µA
V_{ICL}	I/O input clamp voltage (1)	I_{IN} = 1 mA I_{IN} = -1 mA	32	36 -0.7		V V

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

Table 6. Protection and diagnostic

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{DIAG} (1)	Status voltage output low	I_{DIAG} = 5 mA (Fault condition)			1	V
V_{SCL} (1)	Status clamp voltage	I_{DIAG} = 1 mA I_{DIAG} = 1 mA	32	36 -0.7		V V
V_{USD}	Undervoltage shut down		5		8	V
I_{LIM}	DC Short circuit current	V_{CC} = 24 V; R_{LOAD} < 10 mΩ	1		2	A
I_{OVPK}	Peak short circuit current	V_{CC} = 24 V; V_{IN} = 30 V; R_{LOAD} < 10 mΩ			4	A
I_{DIAGH}	Leakage ondiag pin in high state	V_{DIAG} = 24 V			25	µA
I_{LOAD}	Output leakage current	V_{CC} = 10 to 36 V; 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

1. Status determination > 100 µs 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 36 V.

4 Test circuits

Figure 4. Avalance energy test circuit

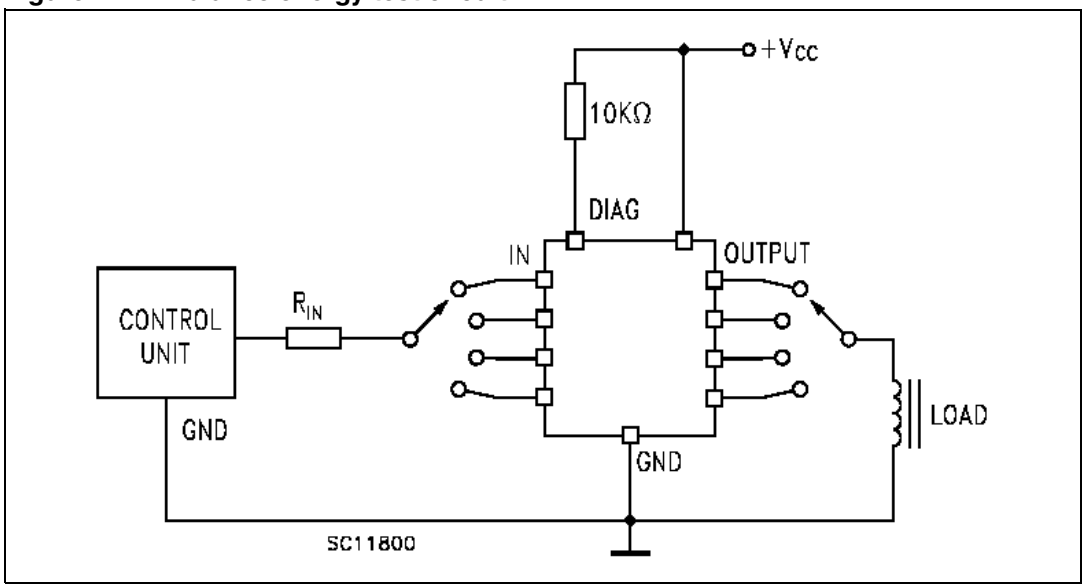


Figure 5. Peak short circuit test diagram

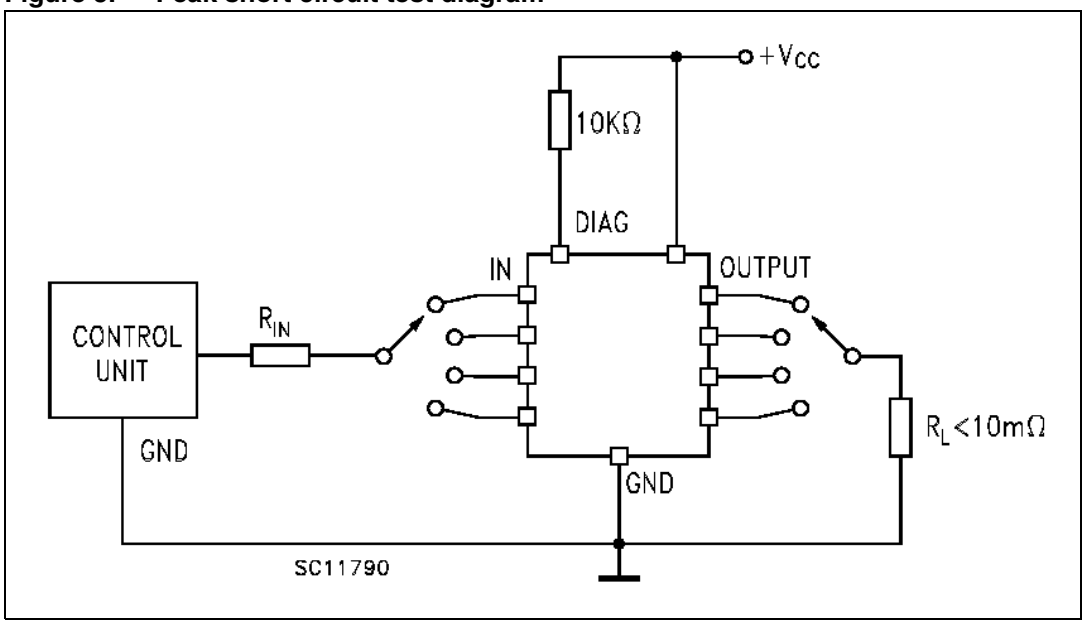
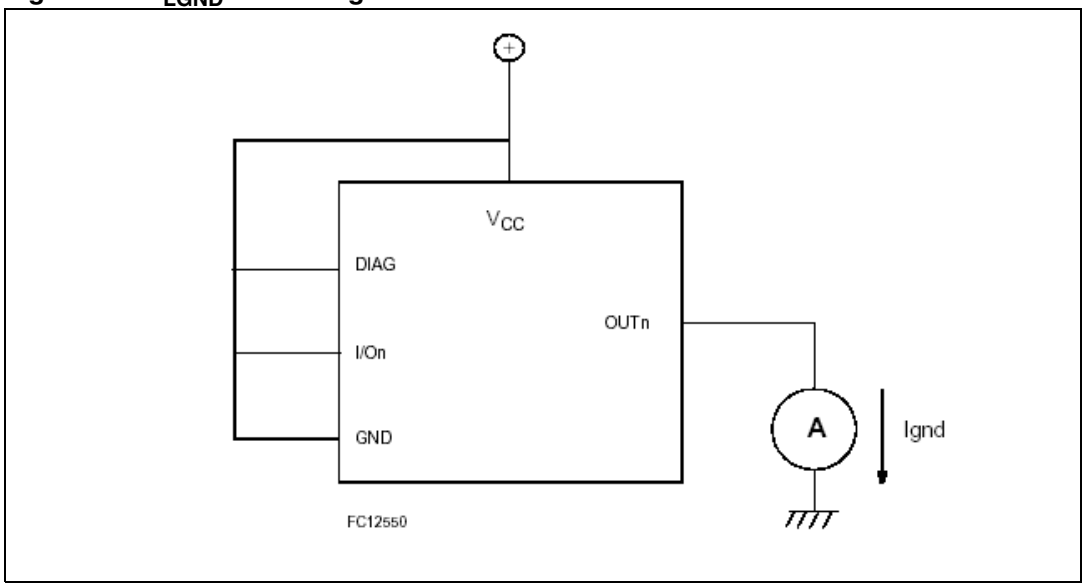


Figure 6. I_{LGND} test configuration



5 Switching time waveforms and truth table

Figure 7. Switching waveforms

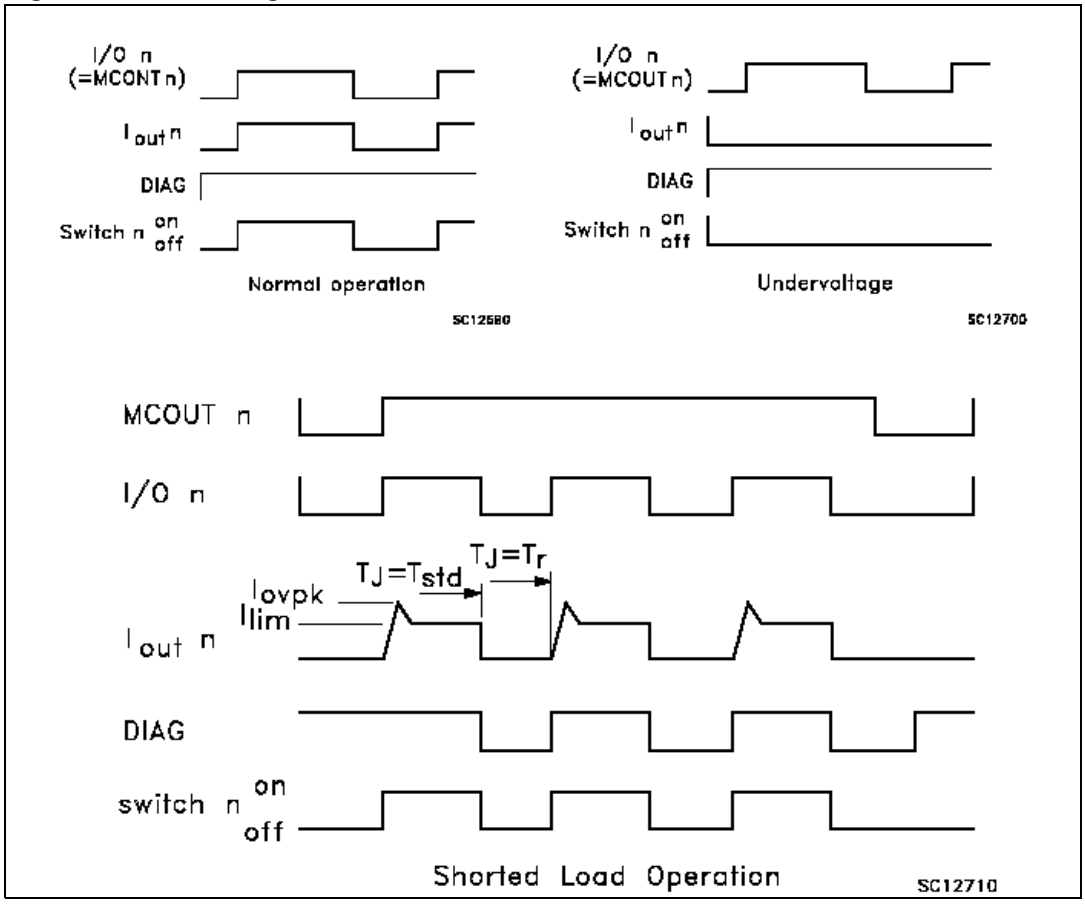


Figure 8. Switching parameter test conditions

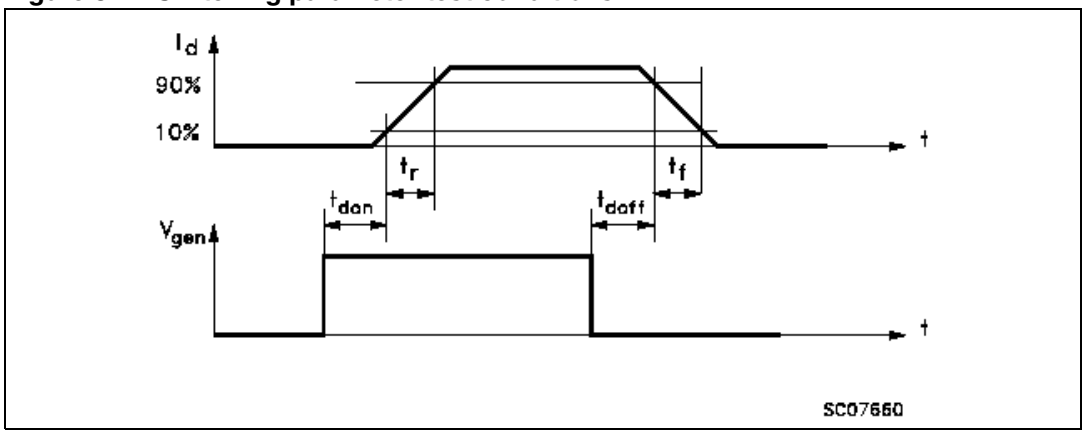
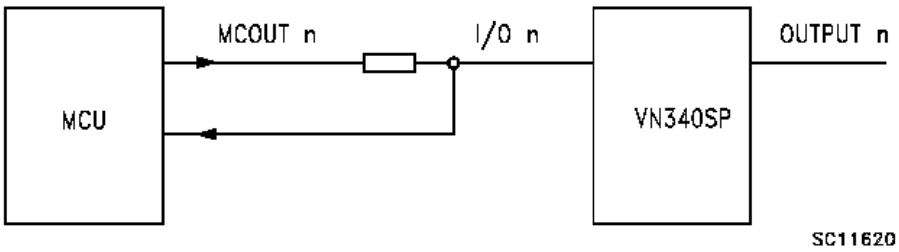


Table 7. Truth table

	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 9. Driving circuit



6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

Table 8. 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	0.23		0.32	0.009		0.012
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	
a	0°		8°			

Figure 10. Package dimension

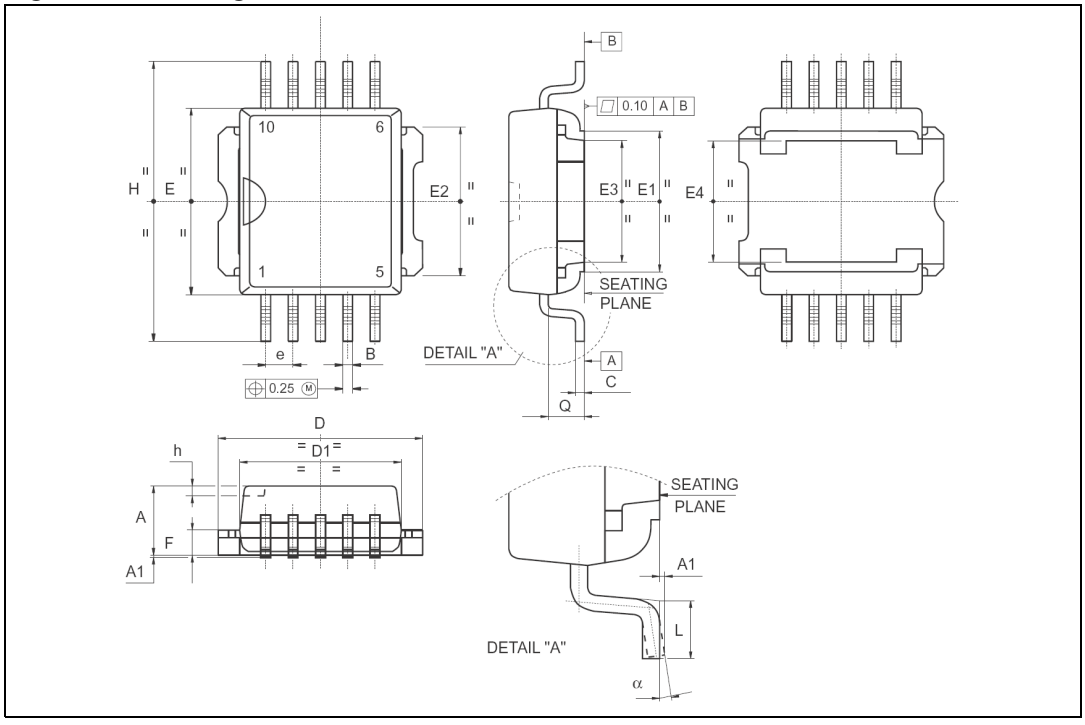
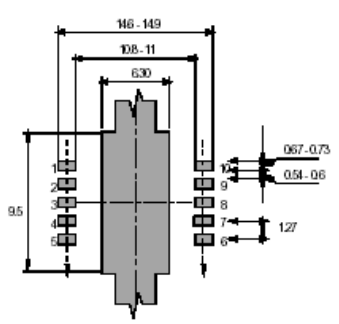
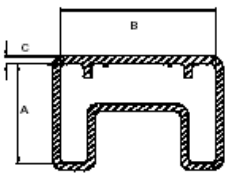
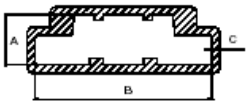


Figure 11. PowerSO-10™ suggested pad and tube shipment (No suffix)





CASABLANCA

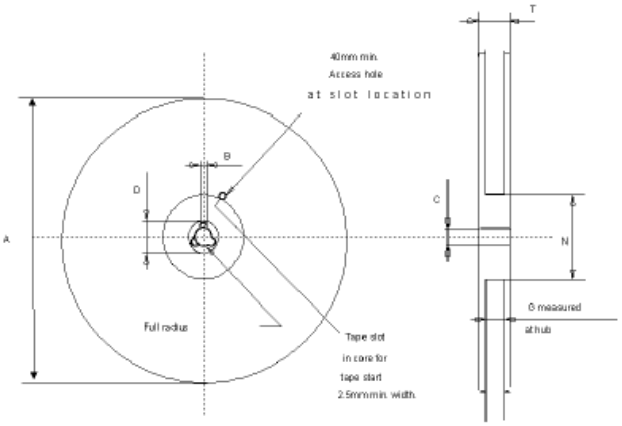


MUAR

All dimensions are in mm.

	Base Q.ty	Bulk Q.ty	Tube length (± 0.5)	A	B	C (± 0.1)
Casablanca	50	1000	532	10.4	16.4	0.8
Muar	50	1000	532	4.9	17.2	0.8

Figure 12. Tape and reel shipment (Suffix "TR")



REEL DIMENSIONS

Base Q.ty	600
Bulk Q.ty	600
A (max)	330
B (min)	1.5
C (± 0.2)	13
F	20.2
G (+ 2 / -0)	24.4
N (min)	60
T (max)	30.4

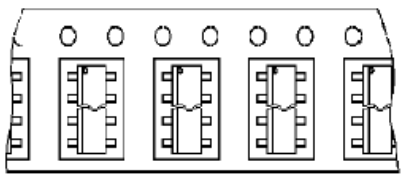
All dimensions are in mm.

TAPE DIMENSIONS

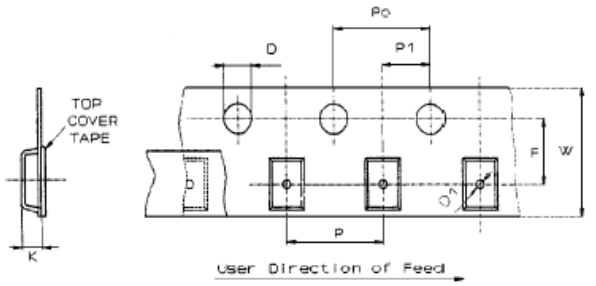
According to Electronic Industries Association (EIA) Standard 481 rev. A, Feb. 1986

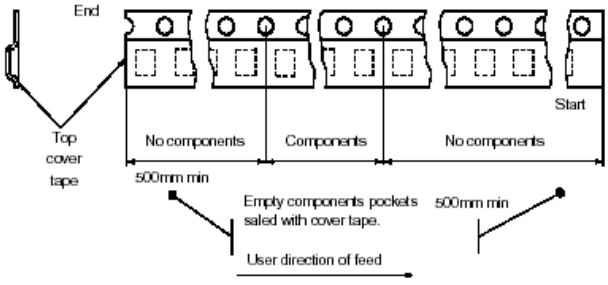
Tape width	W	24
Tape Hole Spacing	P0 (± 0.1)	4
Component Spacing	P	24
Hole Diameter	D (± 0.1/-0)	1.5
Hole Diameter	D1 (min)	1.5
Hole Position	F (± 0.05)	11.5
Compartment Depth	K (max)	6.5
Hole Spacing	P1 (± 0.1)	2

All dimensions are in mm.



User Direction of Feed





7 Order codes

Table 9. Order codes

Order codes	Package	Packaging
VN340SP-33-E	PowerSO-10™	Tube
VN340SPTR-33-E		Tape and reel

8 Revision history

Table 10. Document revision history

Date	Revision	Changes
5-Sep-2005	1	Final release
19-Mar-2007	2	Document reformatted, typo in *Note 1 on page 6*
22-Aug-2008	3	Updated *Table 9*

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