VN330SP(8932)

QUAD HIGH SIDE SMART POWER SOLID STATE RELAY

Table 1. General Features

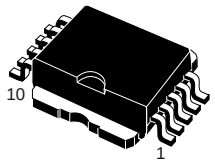
Type	V_{demag}(*)	R_{DSon} (*)	I_{out} (*)	V_{cc}
VN330SP(8932)	V_{CC}-55V	0.32Ω (**)	1A	36V

(*) Per channel

(**) at T_j=85°C

- OUTPUT CURRENT: 1A PER CHANNEL
- DIGITAL INPUTS CLAMPED AT 32V MINIMUM VOLTAGE
- SHORTED LOAD AND OVERTEMPERATURE PROTECTIONS
- BUILT-IN CURRENT LIMITER
- UNDERVOLTAGE SHUTDOWN
- OPEN DRAIN DIAGNOSTIC OUTPUT
- FAST DEMAGNETIZATION OF INDUCTIVE LOADS

Figure 1. Package



PowerSO-10™

DESCRIPTION

The VN330SP(8932) is a monolithic device made using STMicroelectronics VIPower M0-3 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 short-circuit and overtemperature conditions.

Table 2. Order Codes

Package	Tube	Tape and Reel
PowerSO-10™	VN330SP(8932)	VN330SP(8932)TR

Figure 2. Block Diagram

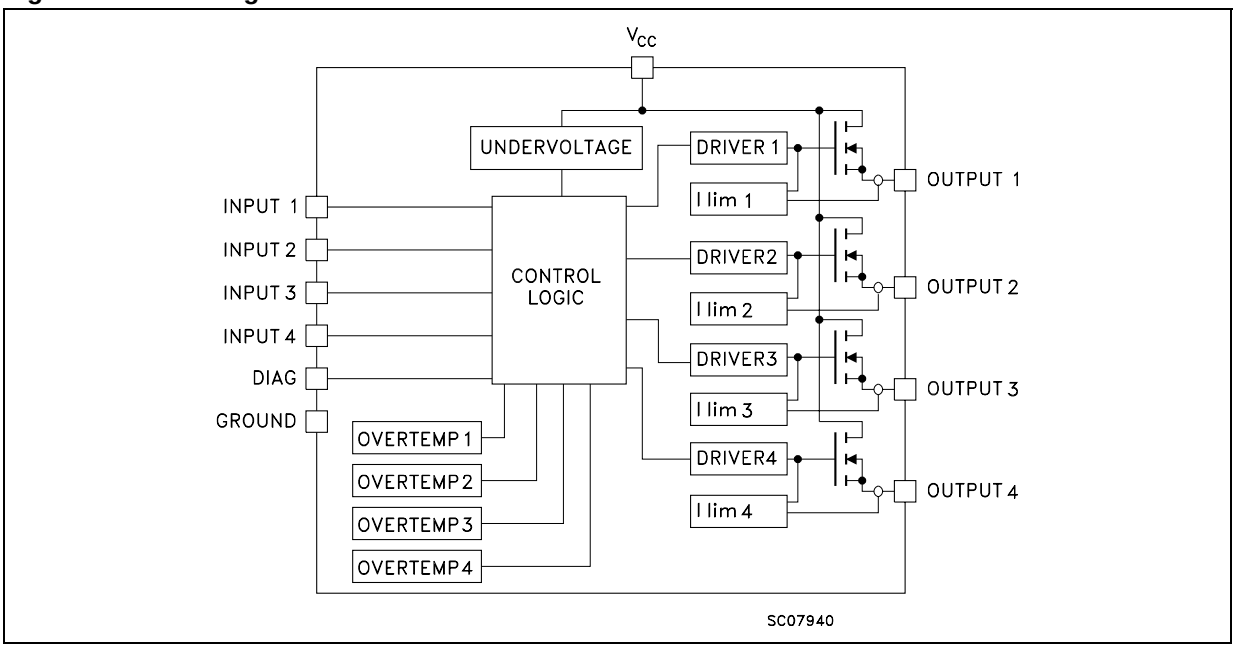


Table 3. Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Power Supply Voltage	45	V
- V_{CC}	Reverse Supply Voltage	- 0.3	V
I_{OUT}	Output Current (cont.)	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 (Human Body Model: R=1.5KΩ; C=100pF)	2000	V
E_{AS}	Single Pulse Avalanche Energy per Channel Not Simultaneously (see figure 5)	400	mJ
P_{tot}	Power Dissipation $T_C \leq 25°C$	Internally Limited	W
T_j	Junction Operating Temperature	Internally limited	°C
T_{STG}	Storage Temperature	- 55 to 150	°C

Figure 3. Configuration Diagram (Top View) & Suggested Connections for Unused and N.C. Pins

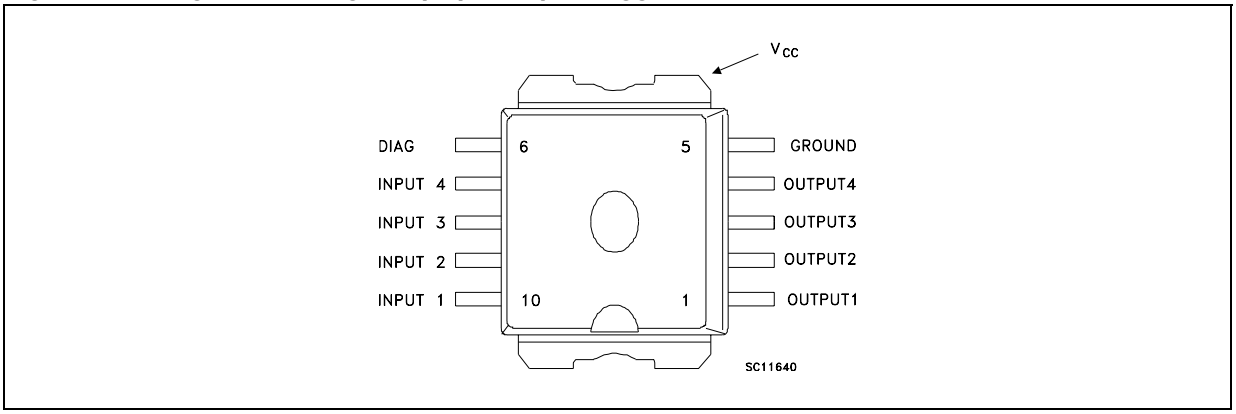


Figure 4. Current and Voltage Conventions

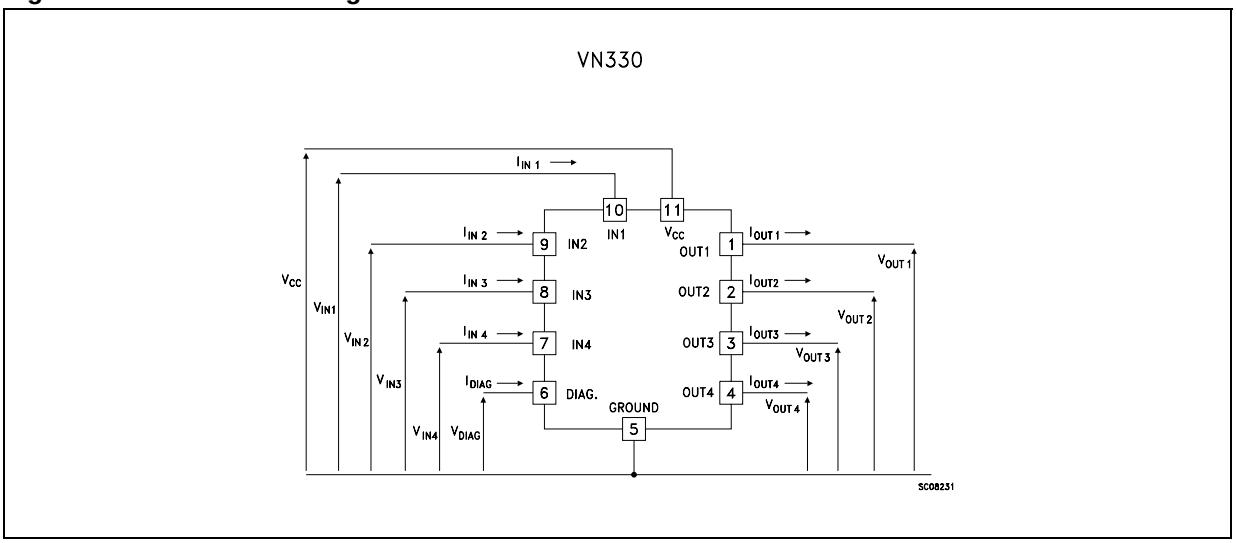


Table 4. Thermal Data

Symbol	Parameter		Value	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case (1)	Max	2	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient (2)	Max	50	°C/W

(1) All channels ON.
(2) When mounted using minimum recommended pad size on FR-4 board.

ELECTRICAL CHARACTERISTICS (10V<V_{CC}<36V; -25°C<T_j<125°C unless otherwise specified)

Table 5. 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 =125°C I_{OUT}=10A			0.4 0.32	Ω Ω
I_S	Supply Current	All channels Off; V_{IN}=30V OnState; T_j=125°C; $I_{OUT1...}I_{OUT4}$=0			1 10	mA mA
V_{demag}	Output Voltage at Turn-Off	I_{OUT}=0.5A; L_{LOAD}=1mH	V_{CC}-65	V_{CC}-55	V_{CC}-45	V

Table 6. Logic Input (each channel)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IL}	Input Low Level Voltage				2	V
V_{IH}	Input High Level Voltage	(See note 1)	3.5			V
$V_{I(hyst)}$	Input Hysteresis Voltage			0.5		V
I_{IN}	Input Current	V_{IN}=0 to 30V V_{IN}=0 to 2V	25		600	µA µA
I_{LGND}	Output Current in Ground Disconnection	V_{CC}=V_{INX}=GND=DIAG=24V; T_j =25°C			25	mA
V_{ICL}	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 10 mA.

ELECTRICAL CHARACTERISTICS (continued)

Table 7. 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 T_j=125°C		 30	 40 60	 µs µs
t_r	Rise Time of Output Current	I_{OUT}=0.5A; Resistive Load Input Rise Time < 0.1µs T_j=25°C T_j=125°C		 50	 100 115	 µs 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 T_j=125°C		 20	 30 40	 µs µs
t_f	Fall Time of Output Current	I_{OUT}=0.5A; Resistive Load Input Rise Time < 0.1µs T_j=25°C T_j=125°C		 8	 15 20	 µs µs
$(di/dt)_{on}$	Turn-on Current Slope	I_{OUT}=0.5A I_{OUT}=I_{lim}; T_j =25°C			0.5 2	A/µs A/µs
$(di/dt)_{off}$	Turn-off Current Slope	I_{OUT}=0.5A I_{OUT}=I_{lim}; T_j =25°C			2 4	A/µs A/µs

Table 8. Protections

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{STAT} (3)	Status Voltage Output Low	I_{STAT}=5mA (Fault condition)			1	V
V_{SCL} (3)	Status Clamp Voltage	I_{STAT}= 1mA I_{STAT}= - 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	1		2.5	A
I_{OVPK}	Peak Short Circuit Current	V_{CC}=24V; V_{IN}=30V; R_{LOAD} < 10mΩ (See figure 6)			4	A
I_{DIAGH}	Leakage on Diag Pin in High State	V_{DIAG}=24V			100	µA
I_{LOAD}	Output Leakage Current	V_{CC}=10 to 36V; V_{IN}=0V; 4 Channels In Parallel			25	µA
t_{SC}	Delay Time of Current Limiter				100	µs
T_{TSD}	Thermal Shut-Down Temperature		150	170		°C
T_R	Reset Temperature		135	155		°C

Note: (3) Status determination > 100 ms after the switching edge.

Note: If INPUTn pin is left floating the corresponding channel will automatically switch off. If GND pin is disconnetted, all channels will switch off provided VCC does not exceed 36V

Figure 5. Avalanche Energy Test Circuit

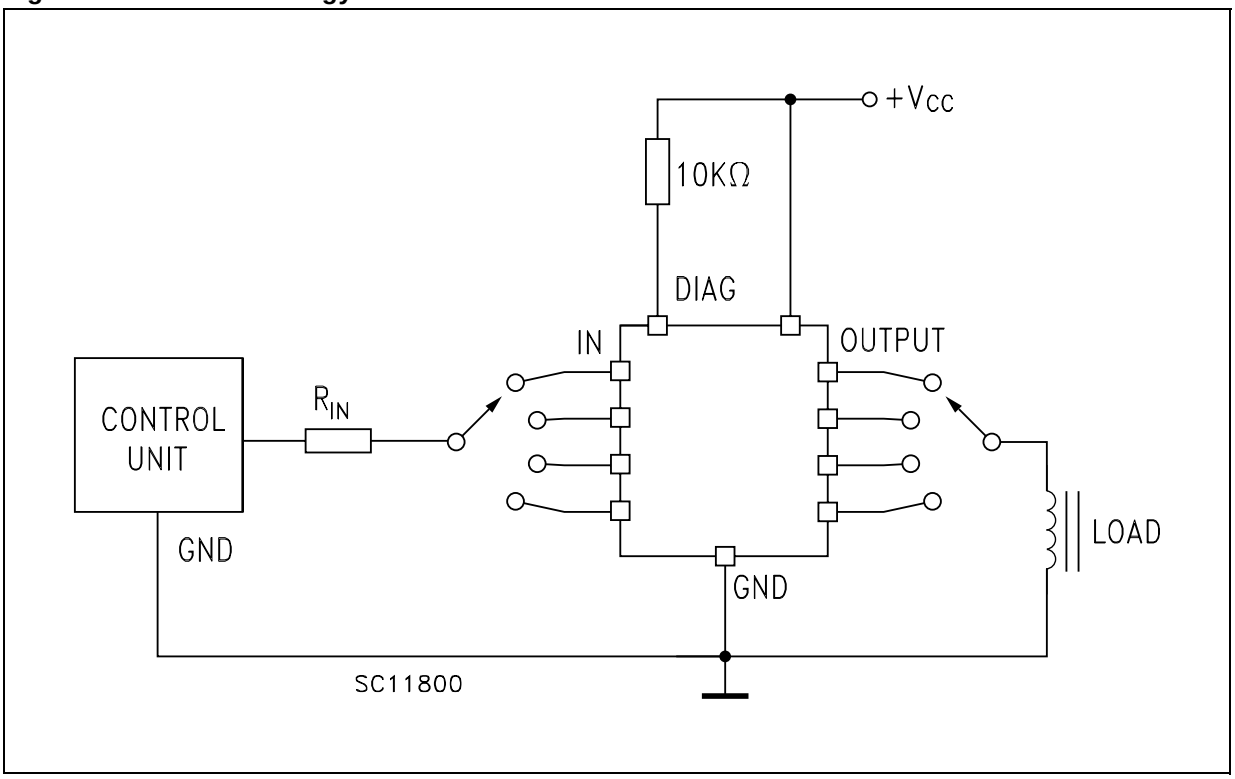


Figure 6. Peak Short Circuit Current Test Circuit

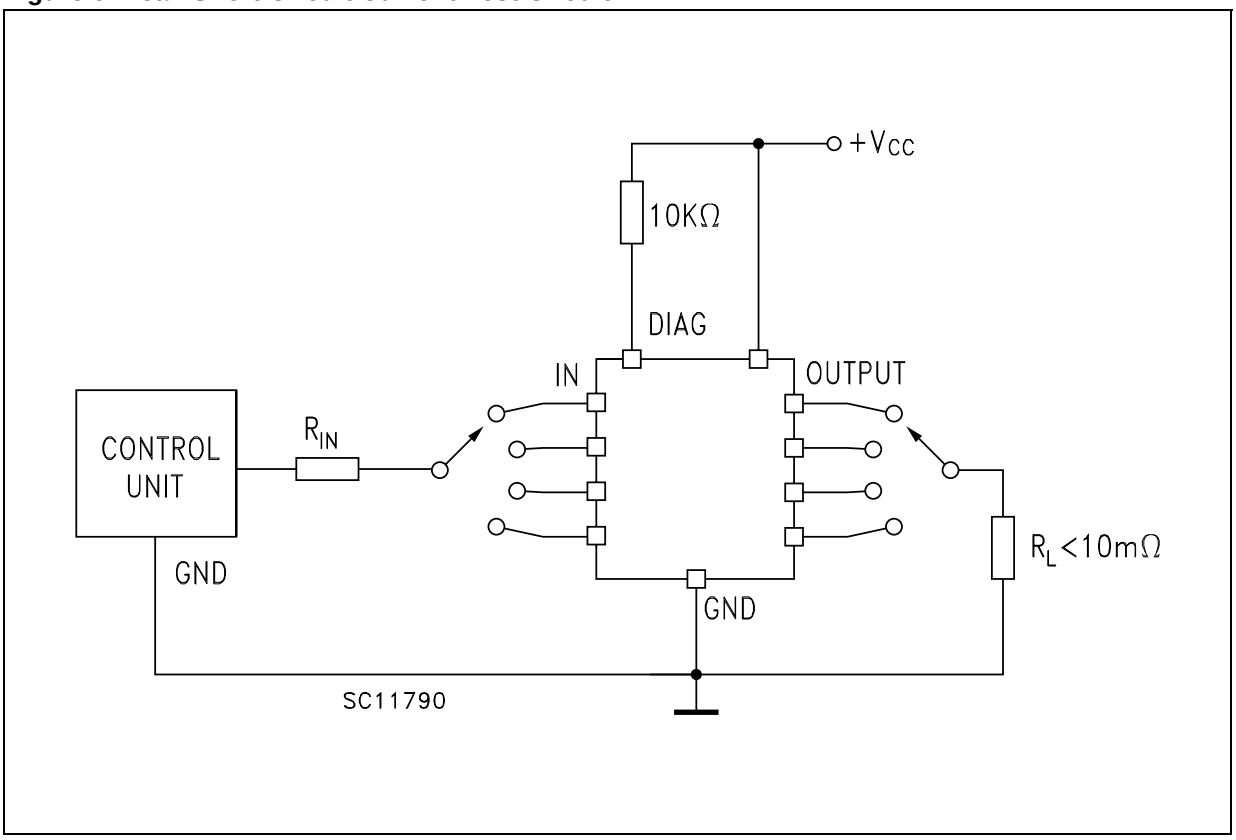


Table 9. Truth Table

CONDITIONS	INPUTn	OUTPUTn	DIAGNOSTIC
Normal operation	L H	L H	H H
Overtemperature	L H	L L	H L
Undervoltage	L H	L L	H H
Shorted Load (Current Limitation)	L H	L H	H H

Figure 7. Switching Waveforms

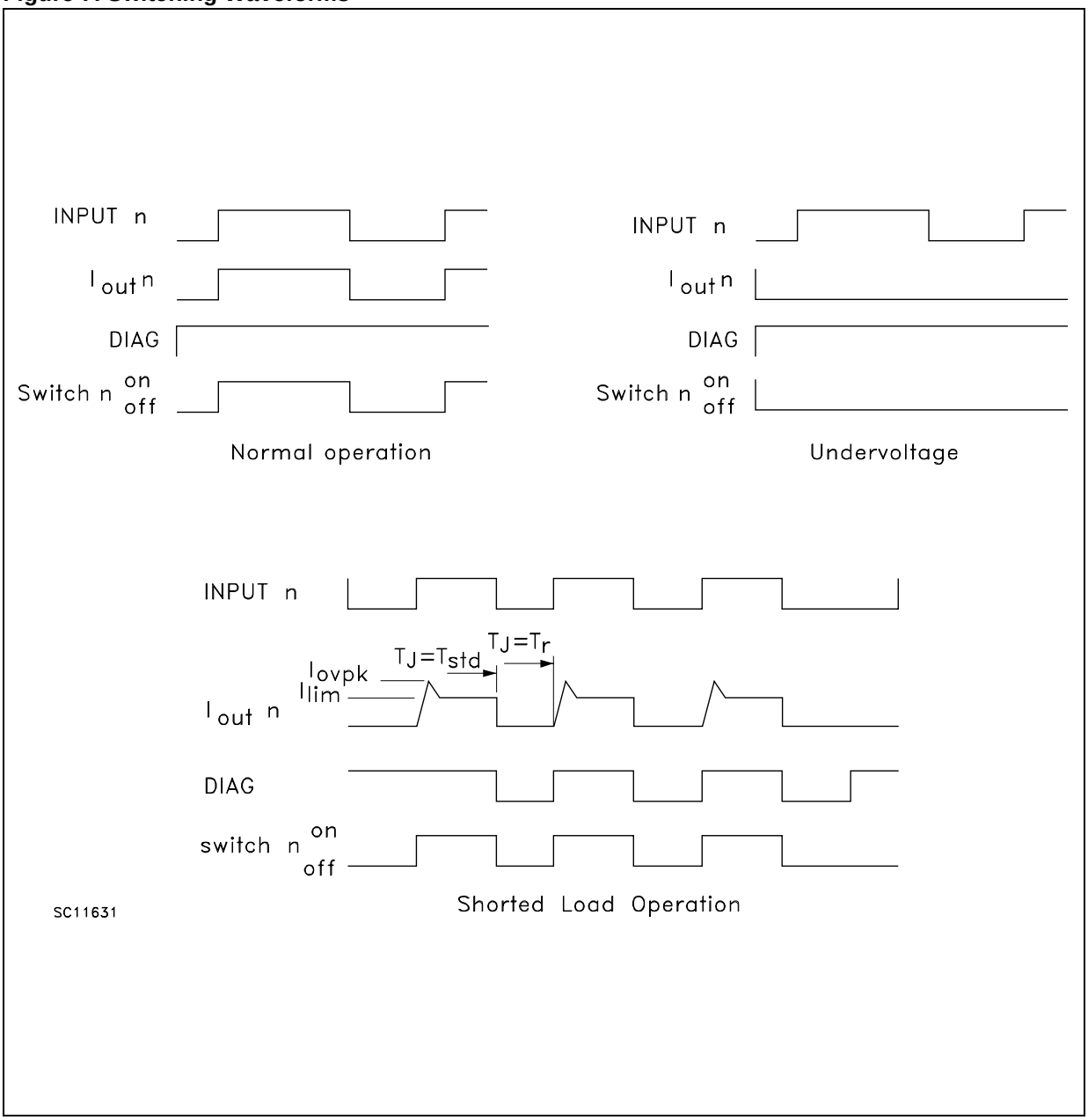


Figure 8. Switching Parameters Test Conditions

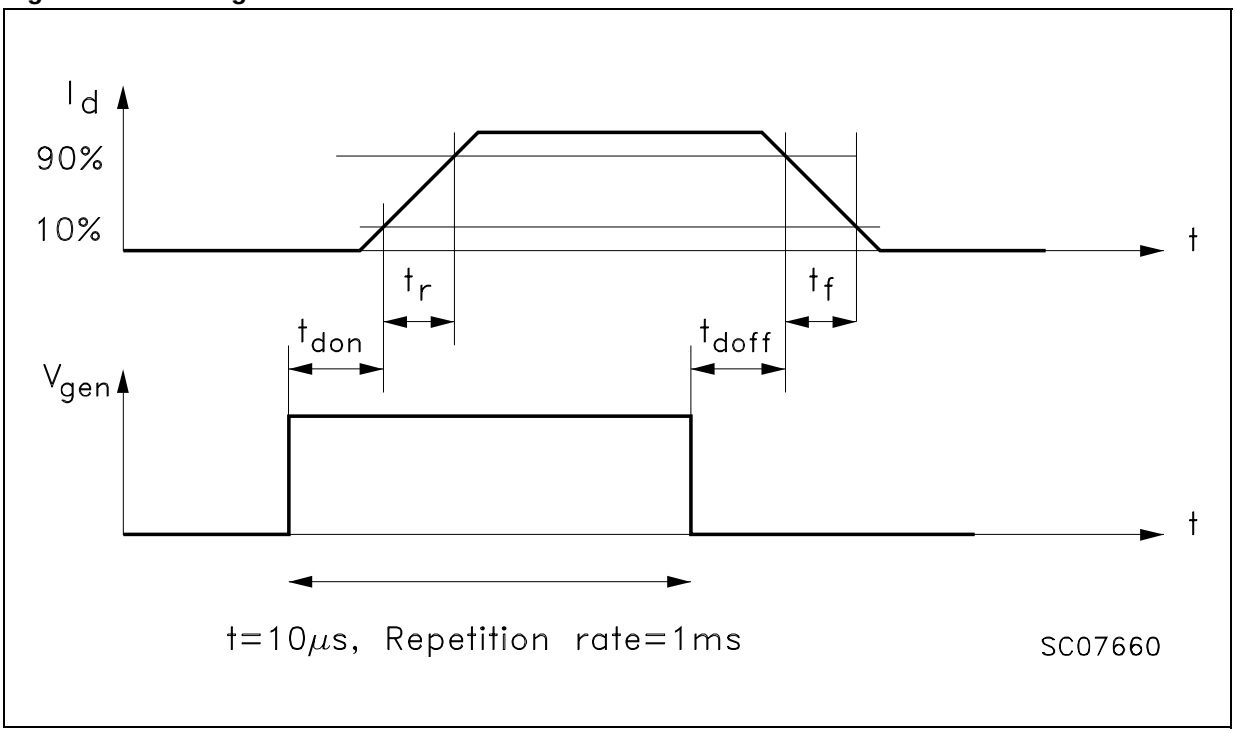
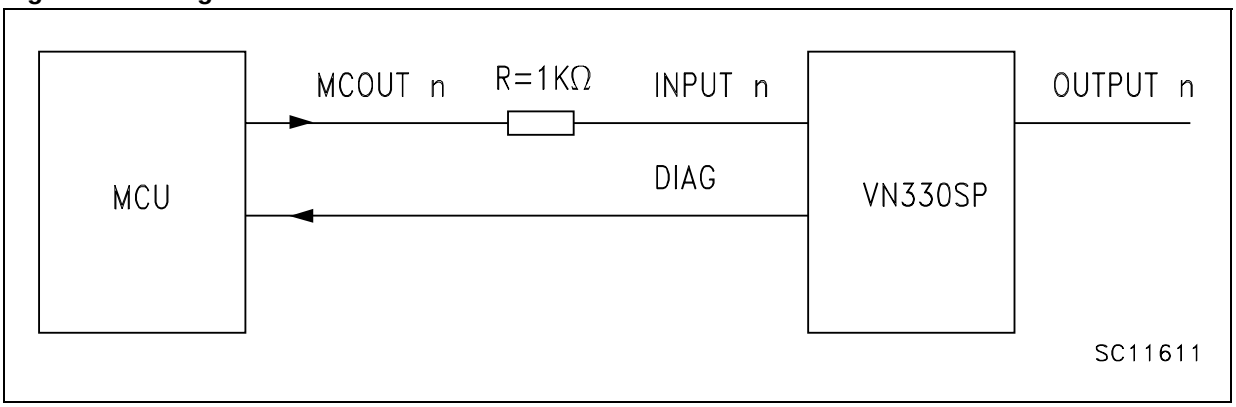
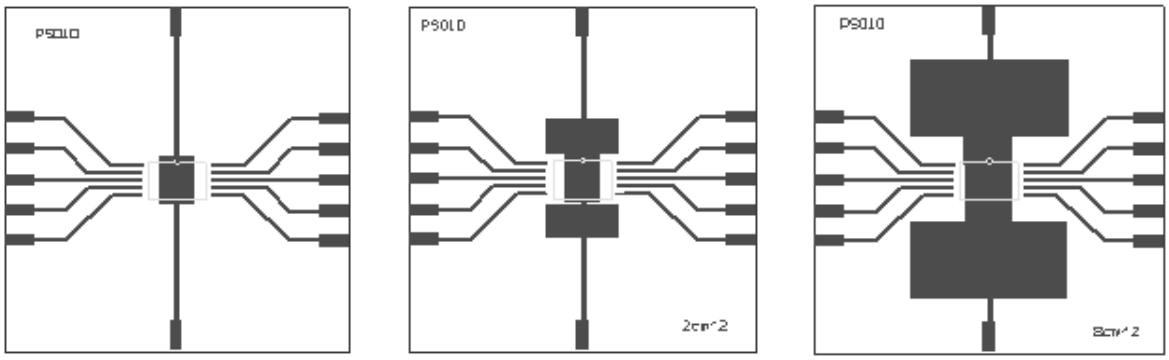


Figure 9. Driving Circuit



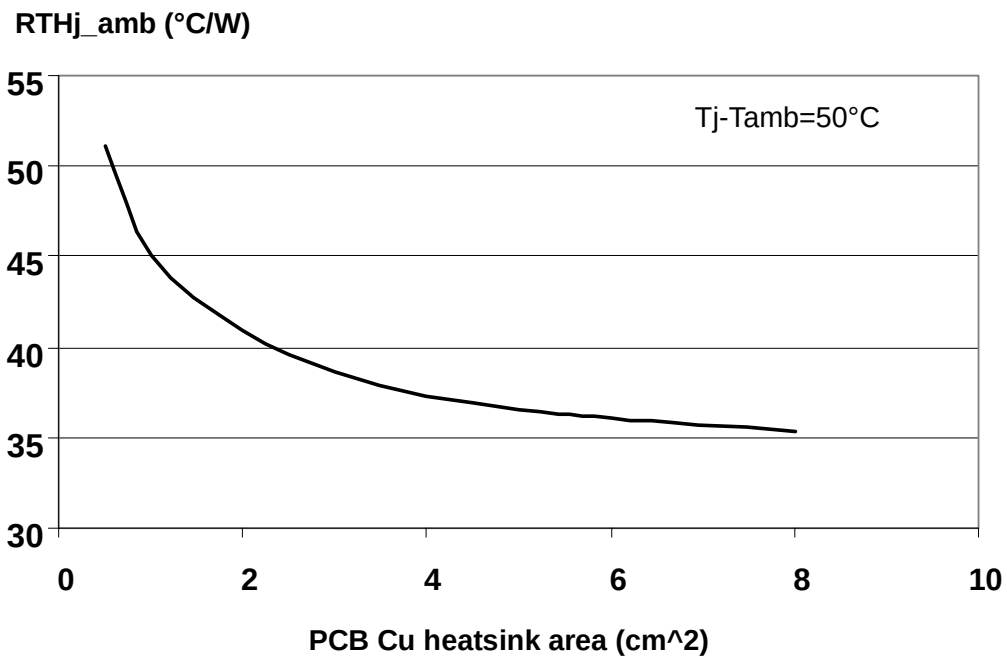
PowerSO-10™ Thermal Data

Figure 10. PowerSO-10™ PC Board



Layout condition of R_{th} and Z_{th} measurements (PCB FR4 area= 58mm x 58mm, PCB thickness=2mm, Cu thickness=35µm, Copper areas: from minimum pad lay-out to 8cm^2).

Figure 11. $R_{thj\text{-}amb}$ Vs PCB copper area in open box free air condition



PACKAGE MECHANICAL

Table 10. PowerSO-10™ Mechanical Data

Symbol	millimeters		
	Min	Typ	Max
A	3.35		3.65
A (*)	3.4		3.6
A1	0.00		0.10
B	0.40		0.60
B (*)	0.37		0.53
C	0.35		0.55
C (*)	0.23		0.32
D	9.40		9.60
D1	7.40		7.60
E	9.30		9.50
E2	7.20		7.60
E2 (*)	7.30		7.50
E4	5.90		6.10
E4 (*)	5.90		6.30
e		1.27	
F	1.25		1.35
F (*)	1.20		1.40
H	13.80		14.40
H (*)	13.85		14.35
h		0.50	
L	1.20		1.80
L (*)	0.80		1.10
a	0º		8º
α (*)	2º		8º

Note: (*) Muar only POA P013P

Figure 12. PowerSO-10™ Package Dimensions

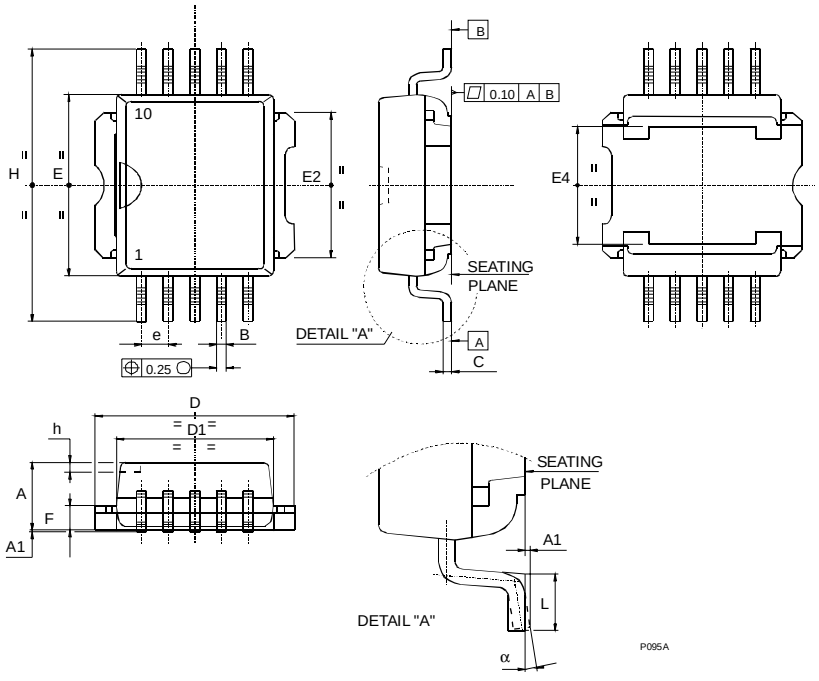
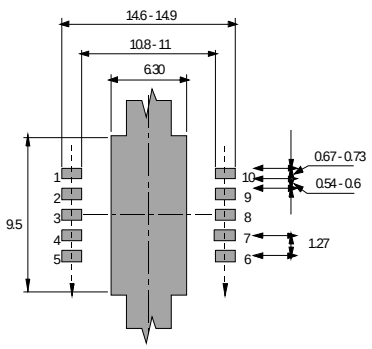
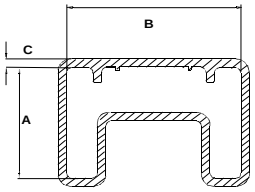
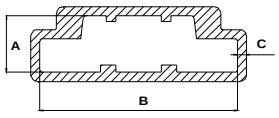


Figure 13. PowerSO-10™ Suggested Pad Layout And Tube Shipment (No Suffix)





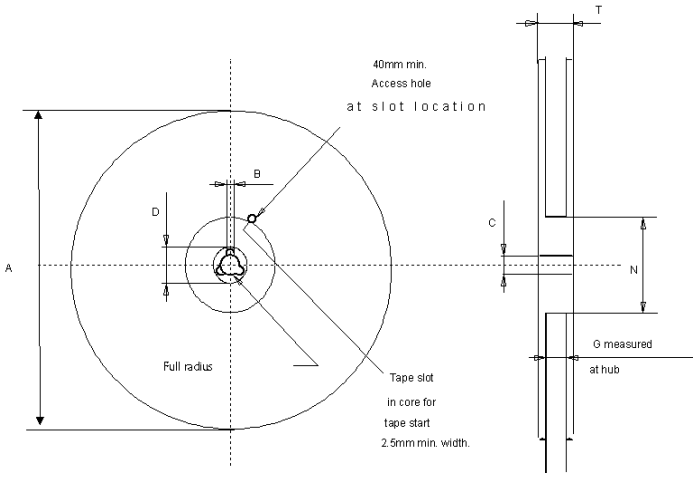
CASABLANCA MUAR



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 14. 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

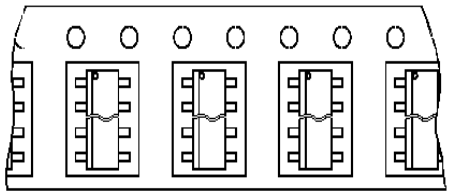
All dimensions are in mm.

TAPE DIMENSIONS

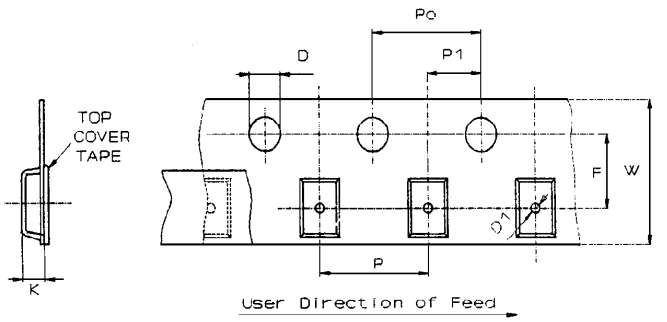
According to Electronic Industries Association (EIA) Standard 481 rev. A, Feb. 1986

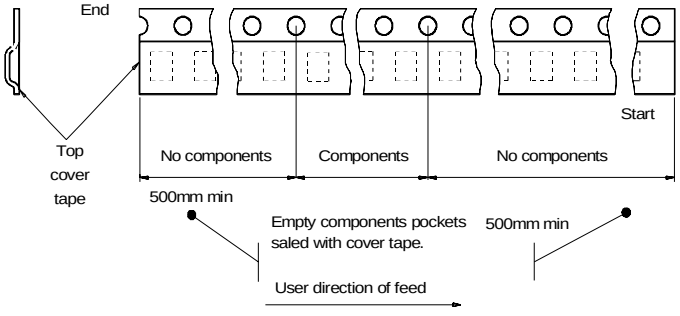
Tape width	**W**	24
Tape Hole Spacing	**P0 (± 0.1)**	4
Component Spacing	**P**	24
Hole Diameter	**D (± 0.1/-0)**	1.5
Hole Diameter	**D1 (min)**	1.5
Hole Position	**F (± 0.05)**	11.5
Compartment Depth	**K (max)**	6.5
Hole Spacing	**P1 (± 0.1)**	2

All dimensions are in mm.



User Direction of Feed





REVISION HISTORY

Table 11. Revision History

Date	Revision	Description of Changes
Sep-2004	1	- First Issue