



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

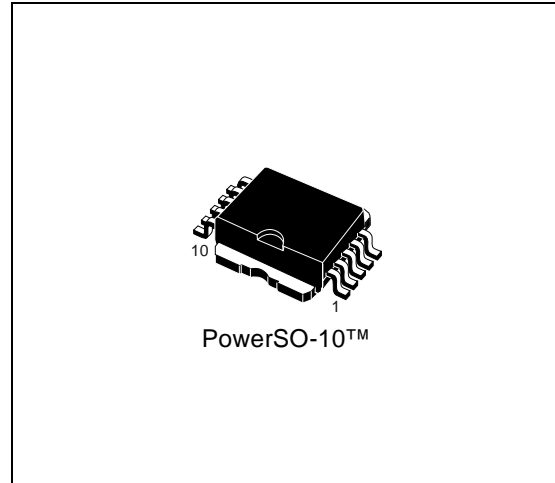
(**) at T_J=85°C

- 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

DESCRIPTION

The VN330SP(8932) is a monolithic device made using STMicroelectronics VIPower M0-3 Technology, intended for driving four independent resistive or inductive loads with one side connected to ground.

Figure 1. Package



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

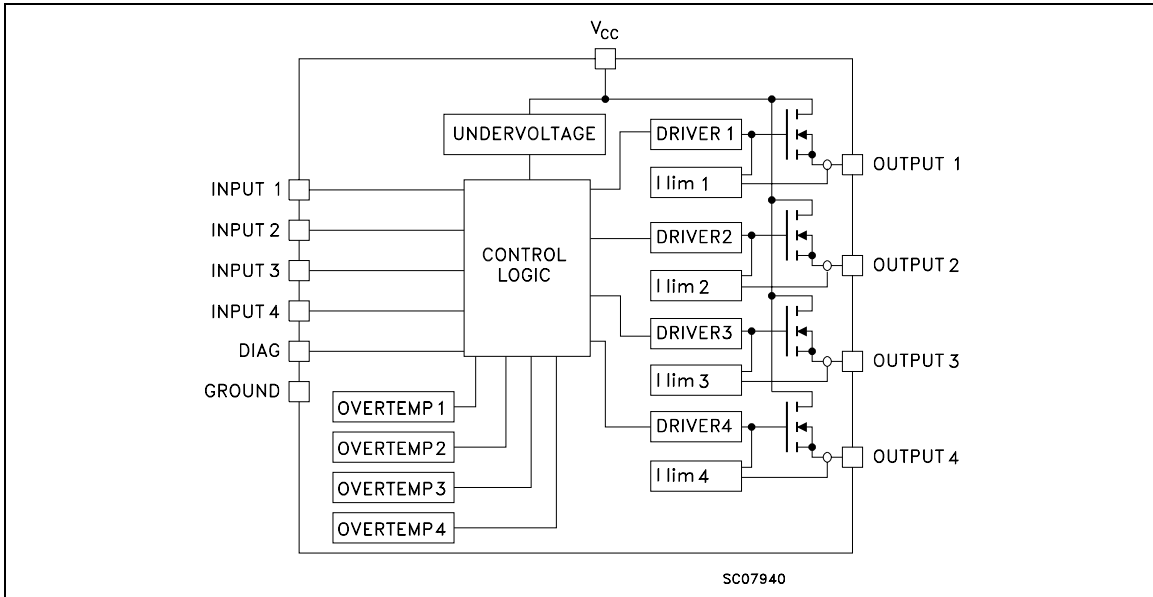


Table 3. Absolute Maximum Ratings

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 ≤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

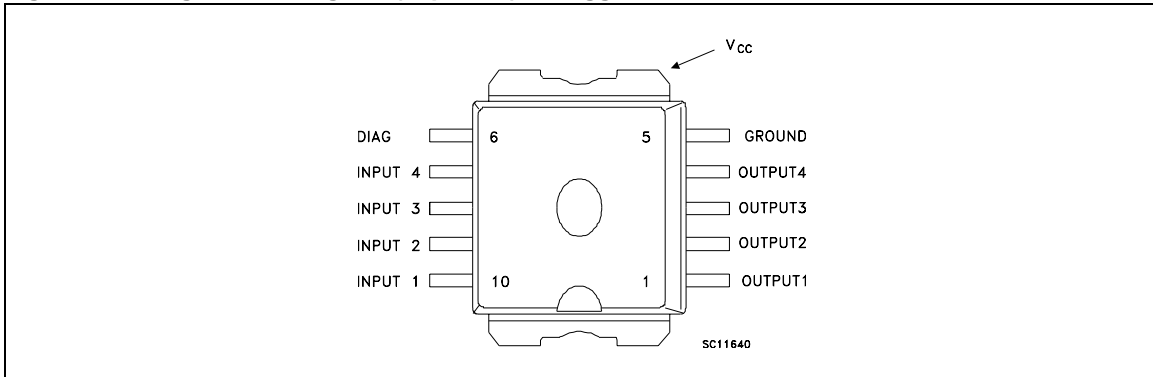


Figure 4. Current and Voltage Conventions

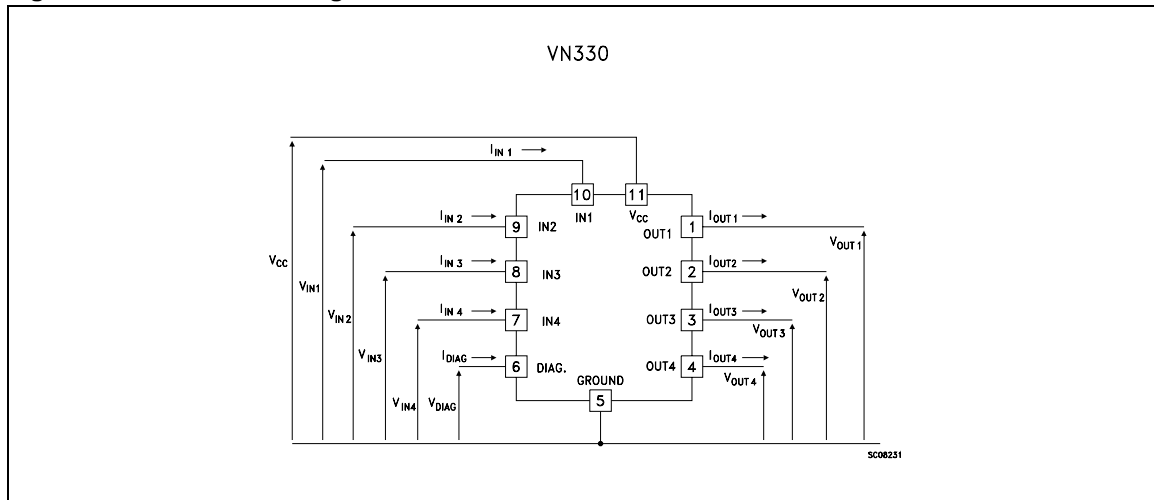


Table 4. Thermal Data

Symbol	Parameter	Value	Unit
R _{thj-case}	Thermal Resistance Junction-case ⁽¹⁾	Max	2 °C/W
R _{thj-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 $< 0.1\mu s$ $T_j=25^\circ C$ $T_j=125^\circ C$		30	40 60	μs μs
t_r	Rise Time of Output Current	$I_{OUT}=0.5A$; Resistive Load Input Rise Time $< 0.1\mu s$ $T_j=25^\circ C$ $T_j=125^\circ C$		50	100 115	μs μs
$t_{d(off)}$	Turn-off Delay Time of Output Current	$I_{OUT}=0.5A$; Resistive Load Input Rise Time $< 0.1\mu s$ $T_j=25^\circ C$ $T_j=125^\circ C$		20	30 40	μs μs
t_f	Fall Time of Output Current	$I_{OUT}=0.5A$; Resistive Load Input Rise Time $< 0.1\mu s$ $T_j=25^\circ C$ $T_j=125^\circ C$		8	15 20	μs μs
$(di/dt)_{on}$	Turn-on Current Slope	$I_{OUT}=0.5A$ $I_{OUT}=I_{lim}$; $T_j = 25^\circ C$			0.5 2	$A/\mu s$ $A/\mu s$
$(di/dt)_{off}$	Turn-off Current Slope	$I_{OUT}=0.5A$ $I_{OUT}=I_{lim}$; $T_j = 25^\circ C$			2 4	$A/\mu s$ $A/\mu s$

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	$V_{CC}=24V$; $R_{LOAD} < 10m\Omega$	1		2.5	A
I_{OVPK}	Peak Short Circuit Current	$V_{CC}=24V$; $V_{IN}=30V$; $R_{LOAD} < 10m\Omega$ (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		$^\circ C$
T_R	Reset Temperature		135	155		$^\circ C$

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 disconnected, all channels will switch off provided VCC does not exceed 36V

Figure 5. Avalanche Energy Test Circuit

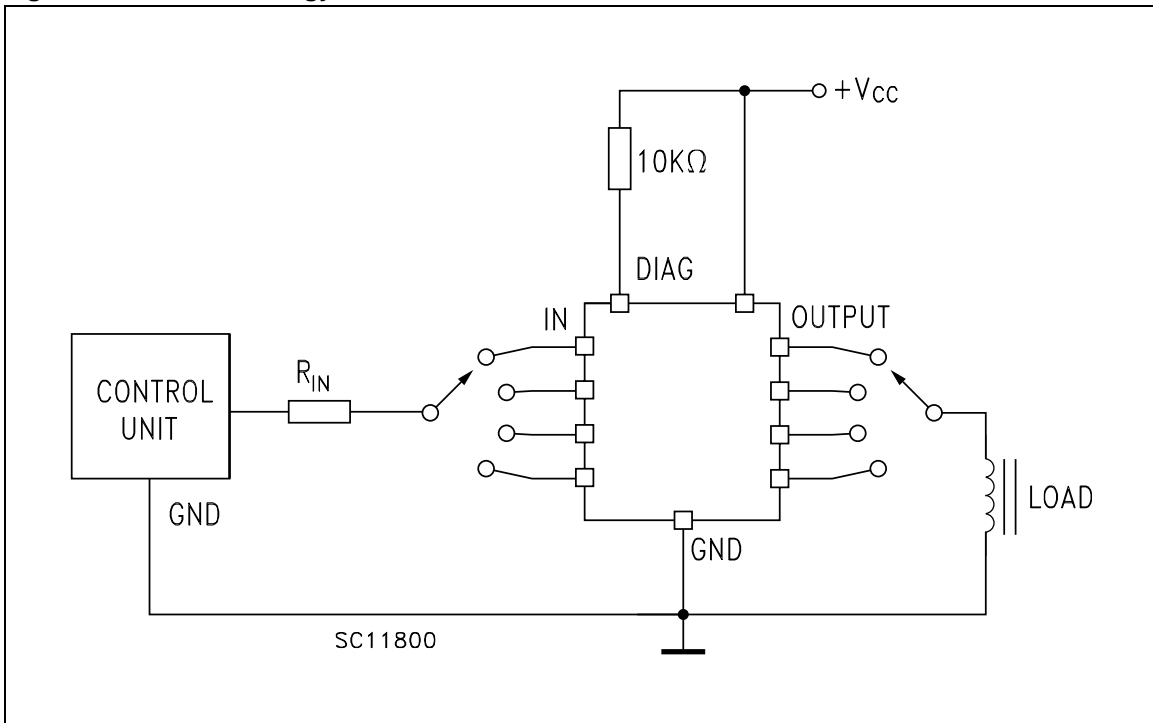


Figure 6. Peak Short Circuit Current Test Circuit

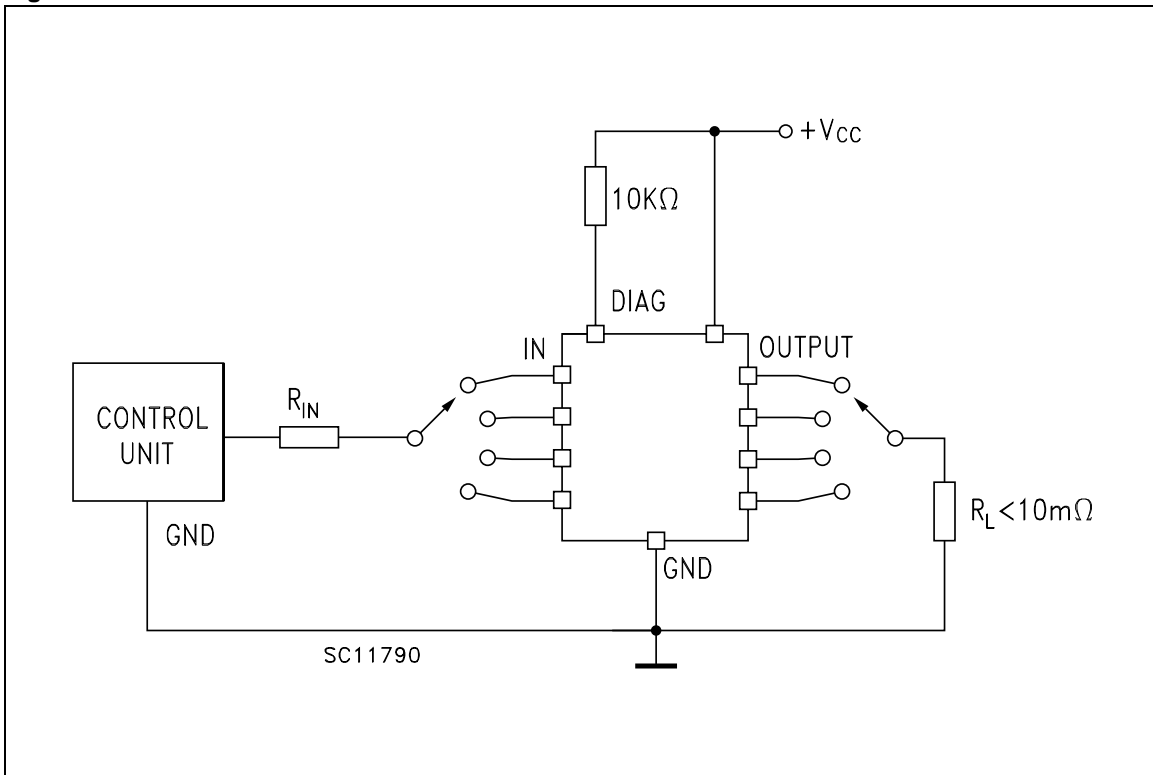


Table 9. Truth Table

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

Figure 7. Switching Waveforms

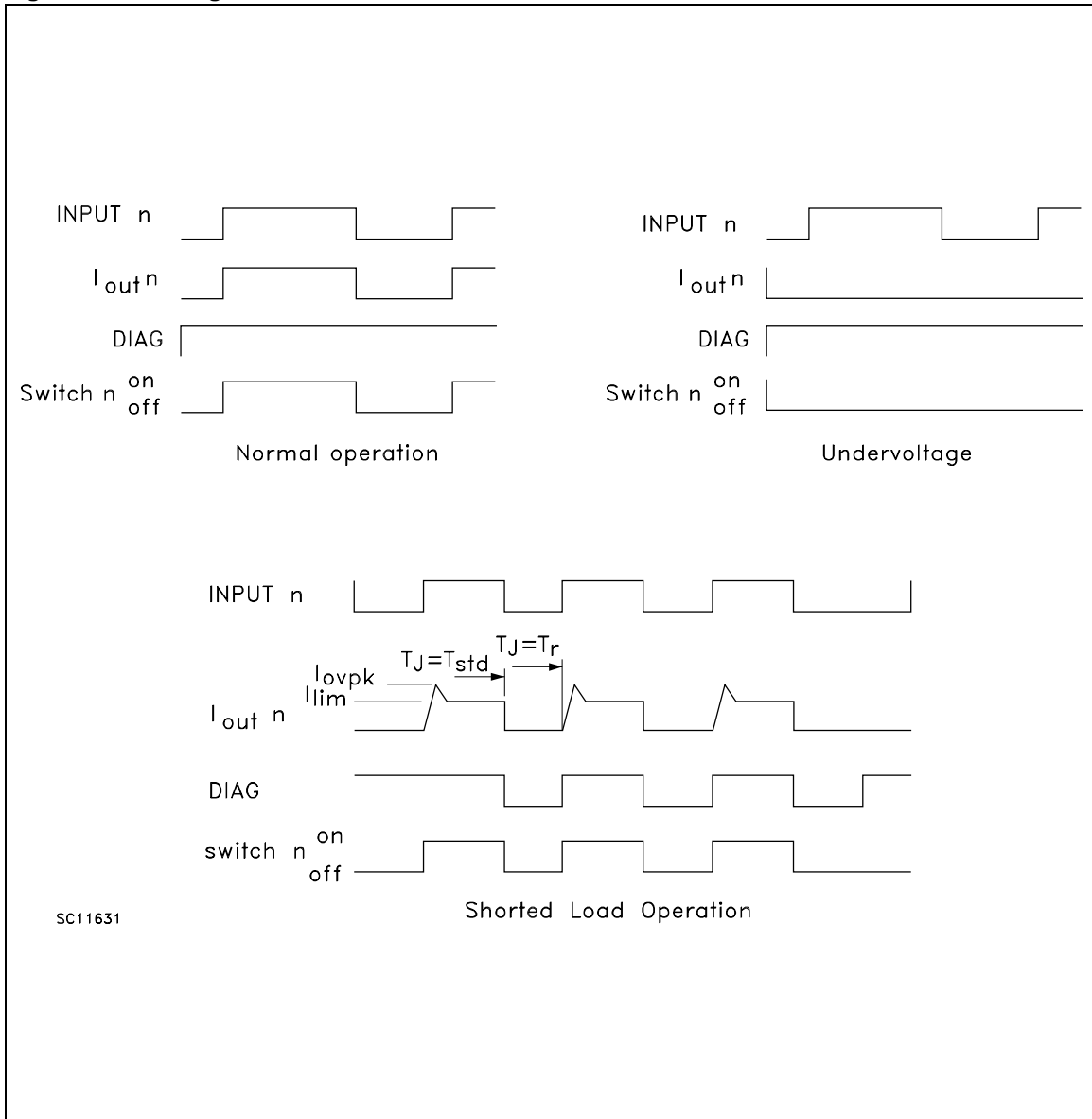


Figure 8. Switching Parameters Test Conditions

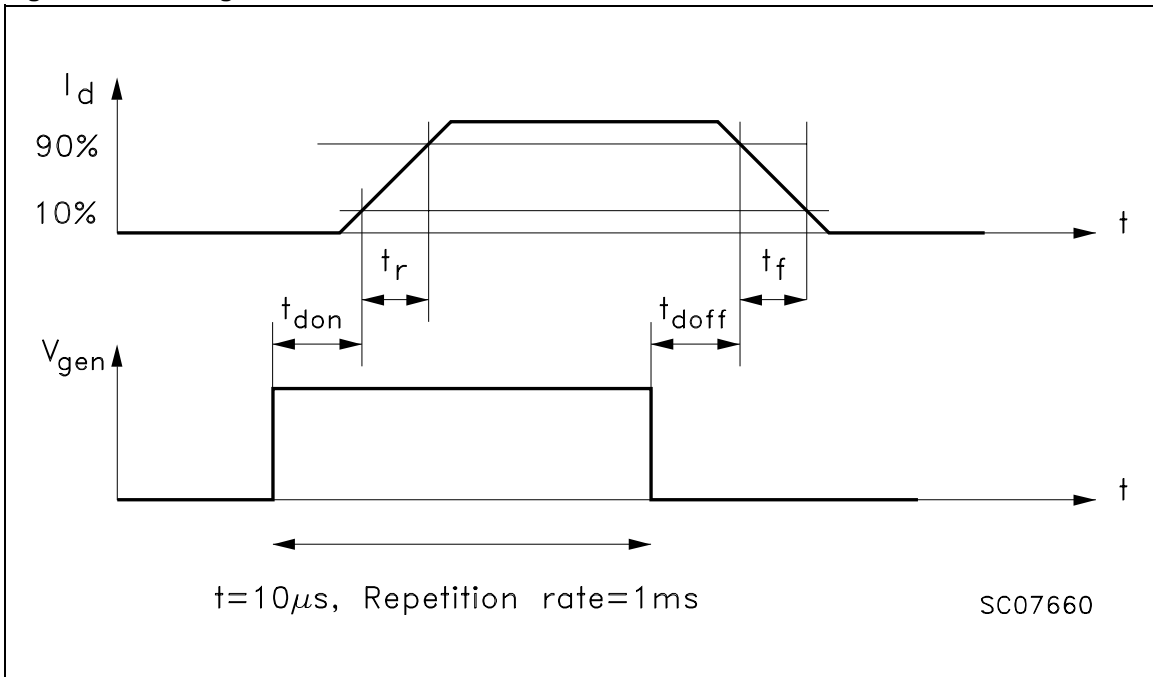
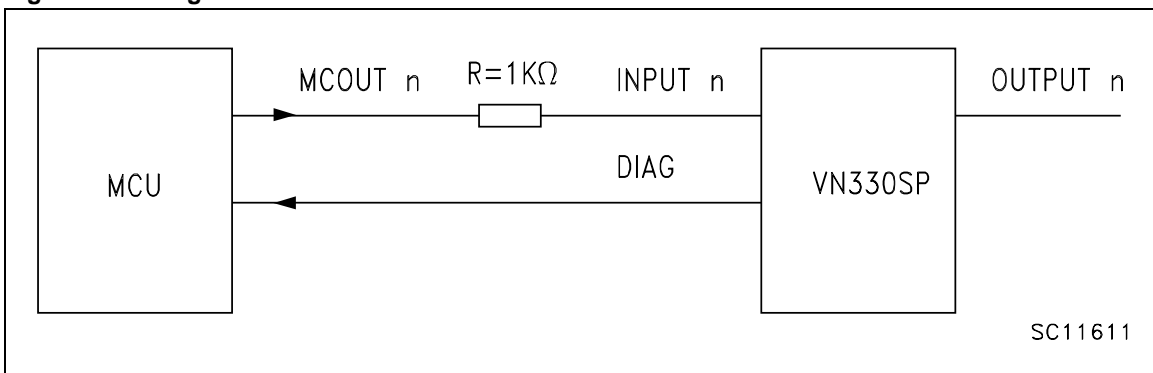


Figure 9. Driving Circuit



PowerSO-10™ Thermal Data

Figure 10. PowerSO-10™ PC Board

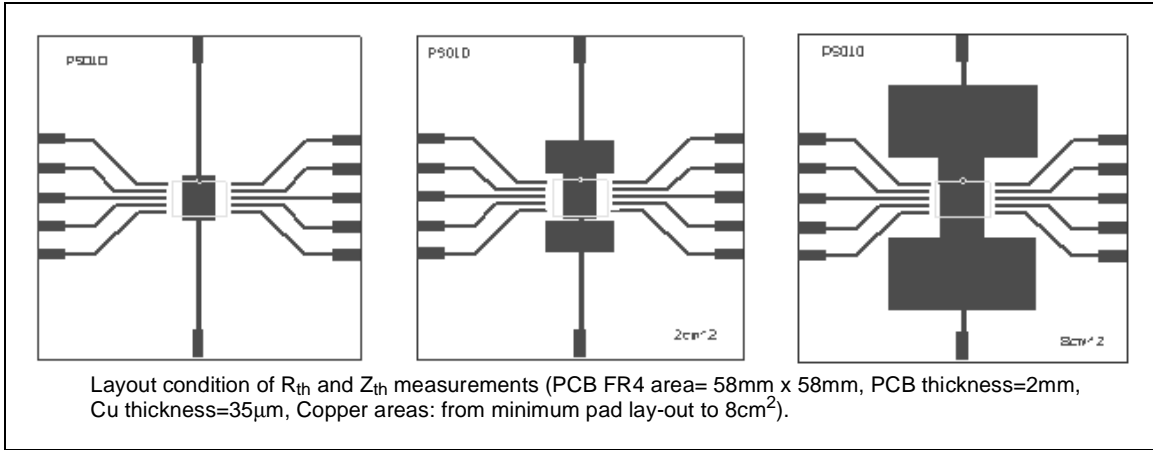
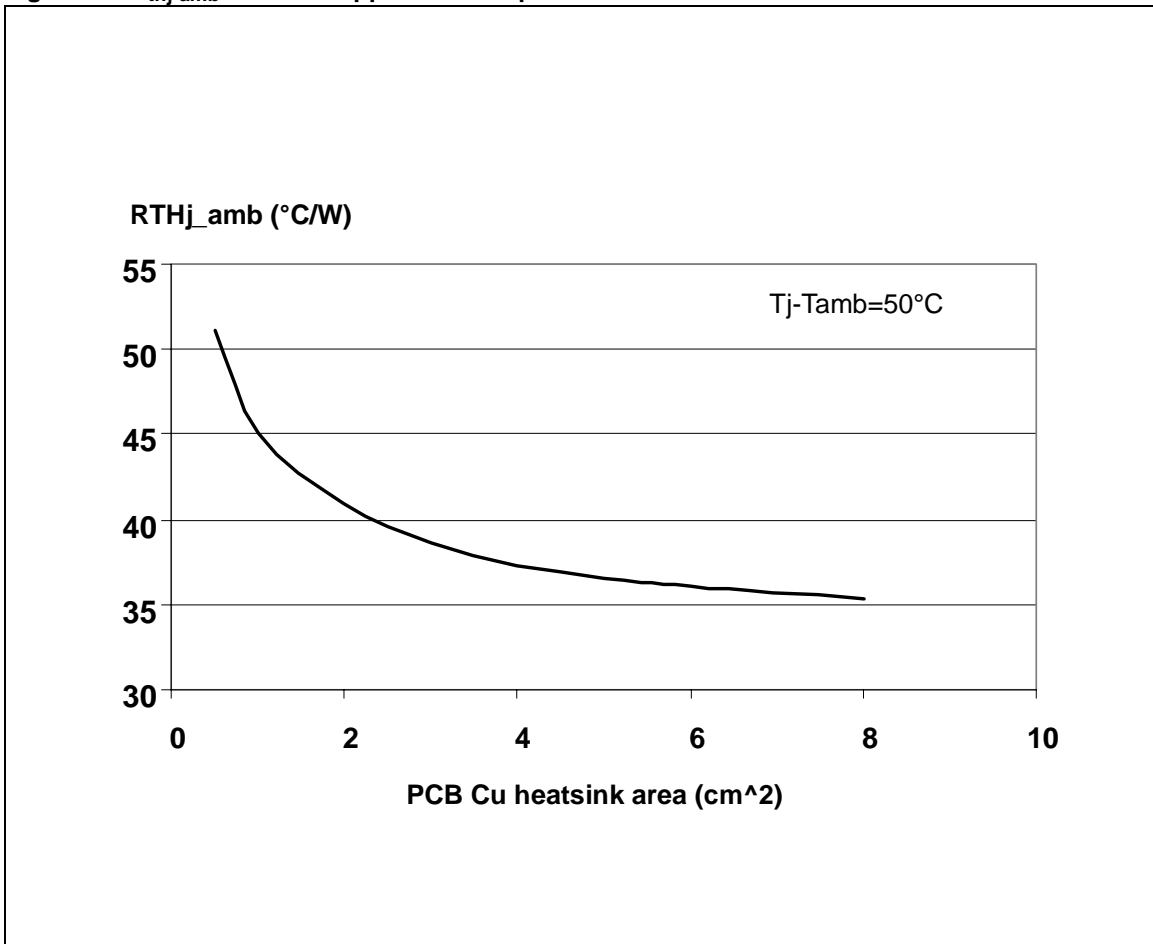


Figure 11. $R_{thj-amb}$ Vs PCB copper area in open box free air condition



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	0°		8°
α (*)	2°		8°

Note: (*) Muar only POA P013P

Figure 12. PowerSO-10™ Package Dimensions

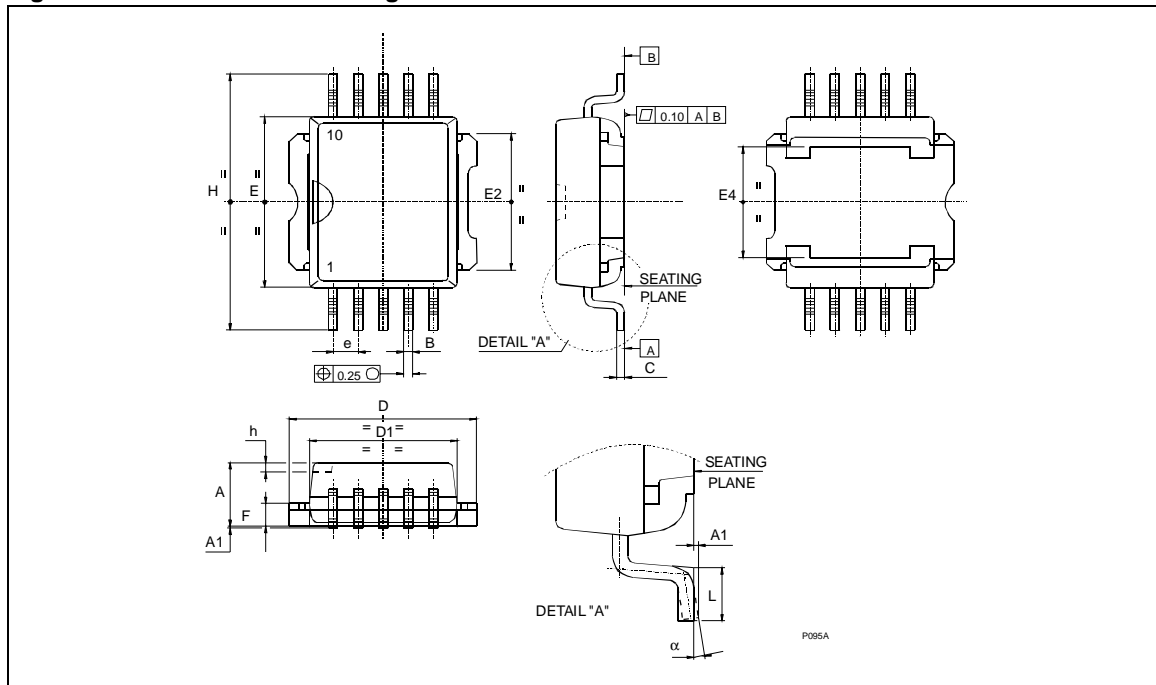


Figure 13. PowerSO-10™ Suggested Pad Layout And Tube Shipment (No Suffix)

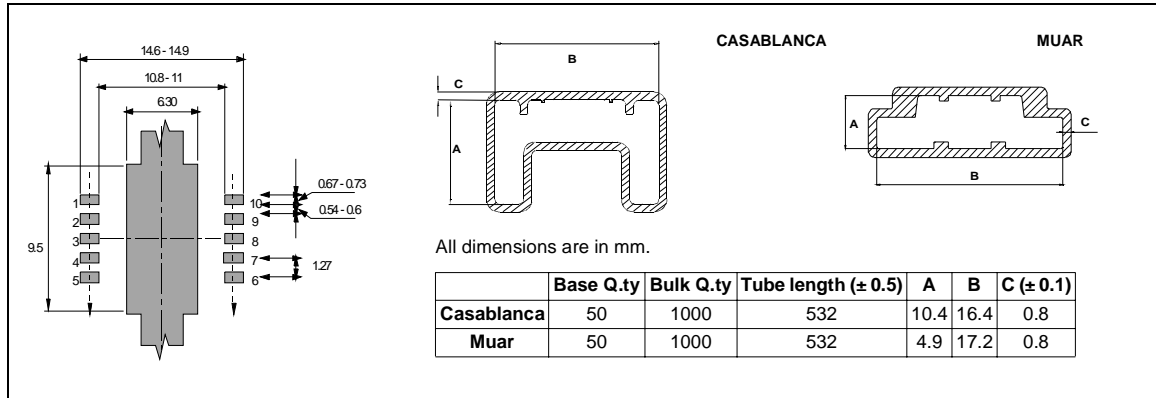
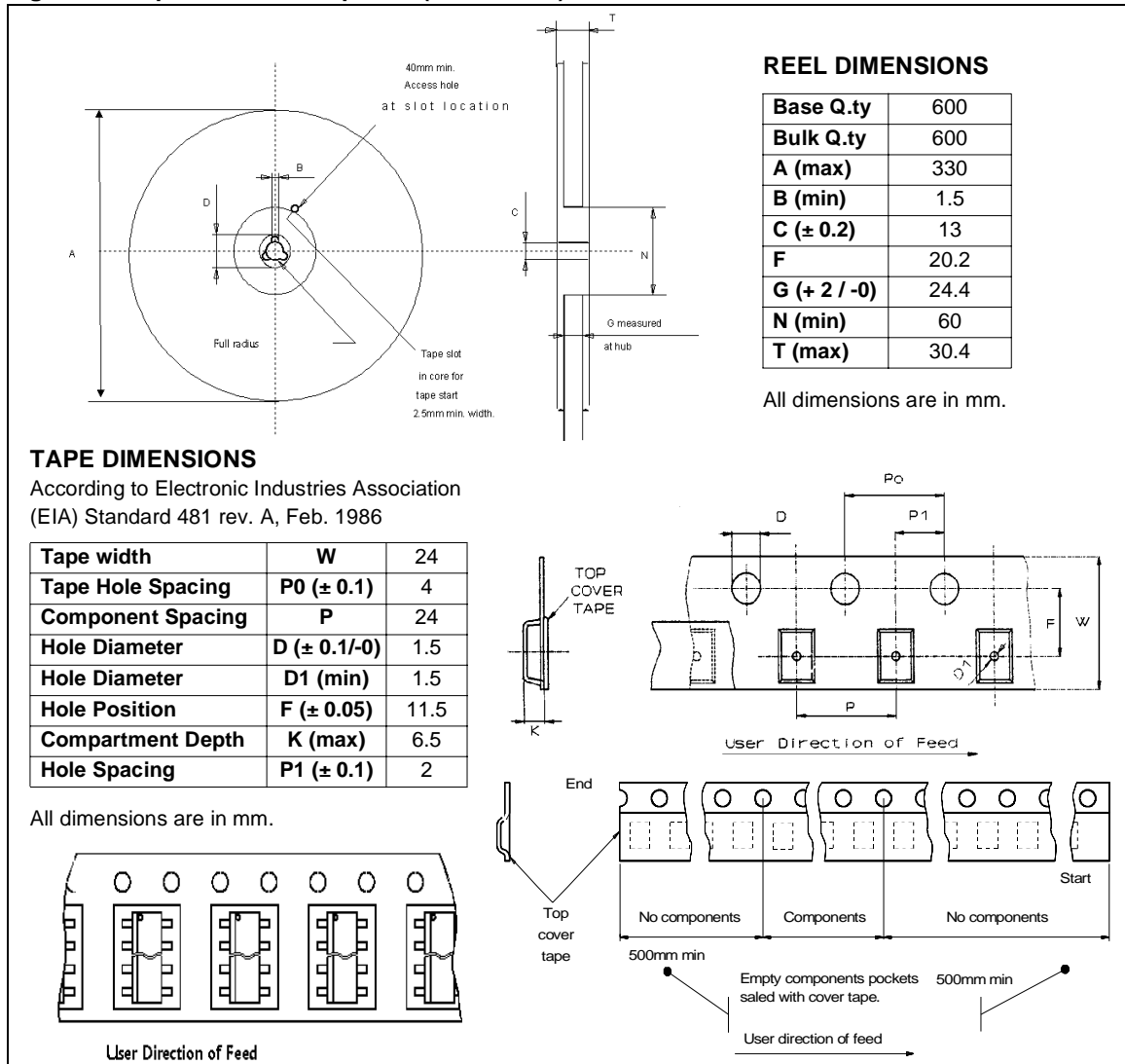


Figure 14. Tape And Reel Shipment (suffix “TR”)



REVISION HISTORY**Table 11. Revision History**

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

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