NSIP9700
Isolation DC to DC Module
Datasheet (EN) 1.0

Product Overview

The NSIP9700 is isolation DC to DC module. The isolated DC-DC converter provides up to 500mW output power using on chip transformer. The feedback PWM signal is sent to primary side by a digital isolator based on Novosense capacity isolation technology. The high integrated solution can help to simplify system design and improve reliability. The NSIP9700 is safety certified by UL1577 support 5.0kVrms withstand voltages, while providing high electromagnetic immunity and low emissions. The NSIP9700 provides 5V to 5V, 5V to 3.3V, 3.3V to 3.3V conversion mode, the output voltage can be set by SEL pin.

Key Features

- Emission optimized to meet CISPR 32 and EN 55032 Class B with >5 dB margin on 2 layers board
- Up to 5000Vrms Insulation voltage
- Power supply voltage: 3V to 5.25V
- 5V to 5V, 5V to 3.3V, support 100mA load current
- 3.3V to 3.3V, support 60mA load current
- Over current and over temperature protection
- High CMTI: 100kV/μs
- High system level EMC performance:

  Enhanced system level ESD, EFT, Surge immunity
- Operation temperature: -40°C ~125°C
- RoHS-compliant packages: SOW16

Safety Regulatory Approvals

- UL recognition: up to 5000V_{rms} for 1 minute per UL1577
- CQC certification per GB4943.1
- CSA component notice 5A
- DIN VDE V 0884-17

Applications

- Industrial automation system
- Isolated SPI, RS232, RS485
- General-purpose multichannel isolation

Device Information

Part Number	Package	Body Size
NSIP9700-DSWR	SOW16	10.30mm × 7.50mm

Functional Block Diagrams

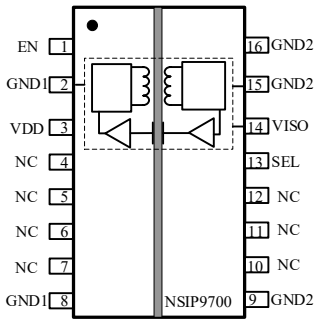


Figure 1. NSIP9700 Block Diagram

INDEX

1. Pin Configuration And Functions

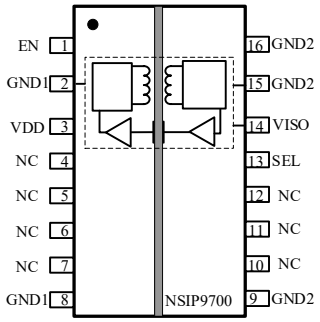


Figure 1.1 NSIP9700 Package

Table1.1 NSIP9700 Pin Configuration and Description

PIN NO.	SYMBOL	FUNCTION
1	EN	Enable pin. When a logic high voltage is applied, the VISO output voltage is active. When a logic low voltage is applied, the VISO output voltage is shut down. Internal weak pull down. It is recommended to directly connect EN to VDD or GND1.
2	GND_1	Ground 1, the ground reference for Isolator Side 1
3	VDD	Power Supply for Isolator Side 1
4	NC	Not connected
5	NC	Not connected
6	NC	Pin6 is connected to a high-resistance node of VDD voltage domain.
7	NC	Pin7 is connected to a high-resistance node of VDD voltage domain.
8	GND_1	Ground 1, the ground reference for Isolator Side 1
9	GND_2	Ground 2, the ground reference for Isolator Side 2.
10	NC	Not connected
11	NC	Not connected
12	NC	Not connected
13	SEL	VISO output voltage select, VISO=5V when SEL short to VISO, VISO=3.3V when SEL short to GND2 or floating.
14	VISO	Secondary Supply Voltage Output for External Load.
15	GND_2	Ground 2, the ground reference for Isolator Side 2.
16	GND_2	Ground 2, the ground reference for Isolator Side 2.

2. Absolute Maximum Ratings[1]

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage[2]	V_{DD} / V_{ISO}	-0.5		6	V	
Voltage at Pin6, Pin7, EN, SEL pins[2]	V_{Pin6} / V_{Pin7} V_{EN} / V_{SEL}	-0.5		VDD+0.5 VISO+0.53	V	
Ambient Temperature	T_a	-40		125	°C	
Storage Temperature	T_{stg}	-40		150	°C	

[1]Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

[2]All voltage values are with respect to the local ground pin (GND1 or GND2) and are peak voltage values.

[3]This value depends on whether the pin is located on the VDD or VISO side. The maximum voltage at the I/O pins should not exceed 6 V.

3. ESD Ratings

	Ratings	Value	Unit
Electrostatic discharge	Human body model (HBM), per AEC-Q100-002-RevD	±8.0	kV
	Charged device model (CDM), per AEC-Q100-011-RevB	±2.0	kV

4. Recommended Operating Conditions

Parameters	Symbol	min	typ	max	unit
Power Supply Voltage	V_{DD}	3		5.25	V
EN Voltage	V_{EN}	0		5.5	V
SEL Voltage	V_{SEL}	0		5.5	V
Operating Temperature	T_{opr}	-40		125	°C

5. Thermal Characteristics

Parameters	Symbol	SOW16	Unit
IC Junction-to-Air Thermal Resistance	θ_{JA}	59.2	°C/W
Junction-to-case (top) thermal resistance	ψ_{JT}	8.7	°C/W
Junction-to-board thermal resistance	ψ_{JB}	23	°C/W

6. Specifications

6.1. Isolated DC/DC Converter Static Specifications

(V_{DD}=4.5V~5.25V, SEL=V_{ISO}, T_a=-40°C to 125°C. Unless otherwise noted, Typical values are at V_{DD} = 5V, T_a = 25°C)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Isolated Supply Voltage	V_{ISO}	4.6	5	5.25	V	I_{ISO} = 0 to 100mA
Positive-going UVLO threshold on V_{DD}	$V_{DD+(UVLO)}$		2.7	3	V	
Negative-going UVLO threshold on V_{DD}	$V_{DD-(UVLO)}$	2.1	2.5		V	
UVLO threshold hysteresis on V_{DD}	$V_{HYS(UVLO)}$		2.7	3	V	
Positive-going threshold on V_{EN}	V_{EN+}			0.7*VDD	V	
Negative-going threshold on V_{EN}	V_{EN-}	0.3*VDD			V	
Line Regulation	$V_{ISO(LINE)}$		2		mV/V	I_{ISO} = 50mA, VDD= 4.5V to 5.25V
Load Regulation	$V_{ISO(LOAD)}$		0.5		%	I_{ISO}= 10 to 90mA
Output Ripple	$V_{ISO(RIP)}$		70		mVpp	20MHz bandwidth, C_{LOAD} = 0.1 μF || 10 μF, I_{ISO} = 100 mA
Efficiency at maximum load current	EFF		49		%	I_{ISO} = 100mA, C_{LOAD} = 0.1μF|| 10μF
Output supply current	I_{ISO}	100			mA	
VDD supply current without digital isolator	I_{VDD_POWER}		36	60	mA	No VISO Load
			200	265	mA	I_{ISO}=100mA
Common Mode Transient Immunity	CMTI	100	150		kV/μs	

(V_{DD}=4.5V~5.25V, SEL=0V, T_a=-40°C to 125°C. Unless otherwise noted, Typical values are at V_{DD} = 5V, T_a = 25°C)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Isolated Supply Voltage	V_{ISO}	3	3.3	3.5	V	I_{ISO} = 0 to 100mA
Positive-going UVLO threshold on V_{DD}	$V_{DD+(UVLO)}$		2.7	3	V	
Negative-going UVLO threshold on V_{DD}	$V_{DD-(UVLO)}$	2.1	2.5		V	
UVLO threshold hysteresis on V_{DD}	$V_{HYS(UVLO)}$		2.7	3	V	
Positive-going threshold on V_{EN}	V_{EN+}			0.7*VDD	V	

Negative-going threshold on V_{EN}	V_{EN-}	0.3*VDD			V	
Line Regulation	$V_{ISO(LINE)}$		2		mV/V	I_{ISO} = 50mA, VDD= 4.5V to 5.25V
Load Regulation	$V_{ISO(LOAD)}$		0.5		%	I_{ISO}= 10 to 90mA
Output Ripple	$V_{ISO(RIP)}$		70		mVpp	20MHz bandwidth, C_{LOAD} = 0.1 μF || 10 μF, I_{ISO} = 100 mA
Efficiency at maximum load current	EFF		40		%	I_{ISO} = 100mA, C_{LOAD} = 0.1μF|| 10μF
Output supply current	I_{ISO}	100			mA	
VDD supply current without digital isolator	I_{VDD_POWER}		32	55	mA	No VISO Load
			165	230	mA	I_{ISO}=100mA
Common Mode Transient Immunity	CMTI	100	150		kV/μs	

(V_{DD}=3V~3.6V, SEL=0V, T_a=-40°C to 125°C. Unless otherwise noted, Typical values are at V_{DD} = 3.3V, T_a = 25°C)

Parameters	***Symbol***	***Min***	***Typ***	***Max***	***Unit***	***Comments***
Isolated Supply Voltage	V_{ISO}	3	3.3	3.5	V	I_{ISO} = 0 to 60mA
Positive-going UVLO threshold on V_{DD}	$V_{DD+(UVLO)}$		2.7	3	V	
Negative-going UVLO threshold on V_{DD}	$V_{DD-(UVLO)}$	2.1	2.5		V	
UVLO threshold hysteresis on V_{DD}	$V_{HYS(UVLO)}$		0.2		V	
Positive-going threshold on V_{EN}	V_{EN+}			0.7*VDD	V	
Negative-going threshold on V_{EN}	V_{EN-}	0.3*VDD			V	
Line Regulation	$V_{ISO(LINE)}$		3		mV/V	I_{ISO} = 30mA, VDD= 3V to 3.6V
Load Regulation	$V_{ISO(LOAD)}$		1		%	I_{ISO}= 10 to 54mA
Output Ripple	$V_{ISO(RIP)}$		45		mVpp	20MHz bandwidth, C_{LOAD} = 0.1 μF || 10 μF, I_{ISO} = 60 mA
Efficiency at maximum load current	EFF		48		%	I_{ISO} = 60mA, C_{LOAD} = 0.1μF|| 10μF
Output supply current	I_{ISO}	60			mA	
VDD supply current without digital isolator	I_{VDD_POWER}		35	57	mA	No VISO Load
			131	170	mA	I_{ISO}=60mA
Common Mode Transient Immunity	CMTI	100	150		kV/μs	

6.2. Typical Performance Characteristics

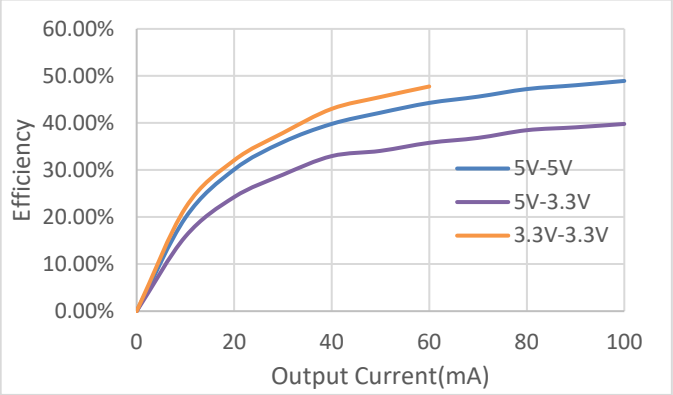


Figure 6.1 Output Current vs Efficiency

7. High Voltage Feature Description

7.1. Insulation and Safety Related Specifications

Parameters	*Symbol*	*Value*	*Unit*	*Comments*
Minimum External Air Gap (Clearance)	CLR	8.15	mm	Shortest terminal-to-terminal distance through air
Minimum External Tracking (Creepage)	CPG	8.15	mm	Shortest terminal-to-terminal distance across the package surface
Distance Through Insulation	DTI	26	μm	Distance through insulation
Tracking Resistance (Comparative Tracking Index)	CTI	>600	V	DIN EN 60112 (VDE 0303-11); IEC 60112
Material Group		I		IEC 60664-1

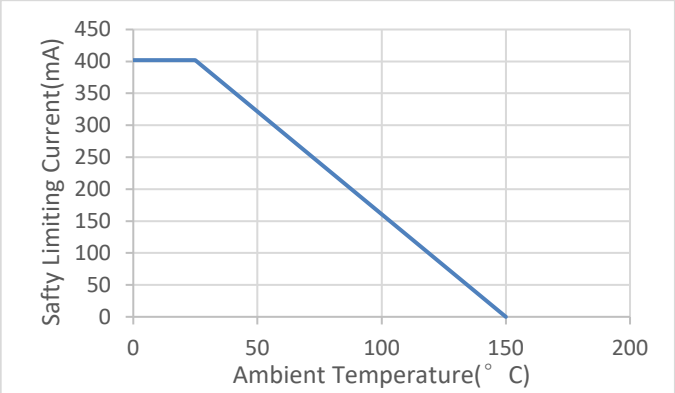
Description	*Test Condition*	*Value*
Overvoltage Category per IEC60664-1	For Rated Mains Voltage ≤ 150Vrms	I to IV
	For Rated Mains Voltage ≤ 300Vrms	I to IV
	For Rated Mains Voltage ≤ 600Vrms	I to III
Climatic Classification		40/125/21
Pollution Degree per DIN VDE 0110,		2

7.2. Insulation Characteristics

Description	*Test Condition*	*Symbol*	*Value*	*Unit*
Maximum repetitive isolation voltage		V_{IORM}	1500	V_{PEAK}

Description	Test Condition	Symbol	Value	Unit
Maximum working isolation voltage	AC Voltage	V_{IOWM}	1061	V_{RMS}
	DC Voltage		1500	V_{DC}
Apparent Charge	Method a, after Input/output safety test subgroup 2/3, Vini=V_{IOTM}, t_{ini} = 60 s , $V_{pd(m)}$=1.2*V_{IORM}, t_m=10s.	q_{pd}	<5	pC
	Method a, after environmental tests subgroup 1, Vini=V_{IOTM}, t_{ini}=60s ,$V_{pd(m)}$=1.6*V_{IORM}, t_m=10s			pC
	Method b, routine test (100% production) and preconditioning (type test);V_{ini}=1.2*V_{IOTM}, t_{ini}=1s $V_{pd\ (m)}$=1.875*V_{IORM}, t_m=1s（method b1）or $V_{pd(m)}$=Vini, t_m=t_{ini}(method b2)			pC
Maximum transient isolation voltage	t = 60 sec	V_{IOTM}	7070	V_{PEAK}
Maximum impulse voltage	Tested in air, 1.2/50μs waveform per IEC62368-1	V_{IMP}	7600	V_{PEAK}
Maximum Surge Isolation Voltage	Test method per IEC62368-1, 1.2/50μs waveform, $V_{IOSM} \geq V_{IMP} \times 1.3$	V_{IOSM}	10000	V_{PEAK}
Isolation resistance	V_{IO} =500V, T_{amb}=25°C	R_{IO}	>10^{12}	Ω
	V_{IO} =500V, 100°C ≤ T_{amb} ≤ 125°C	R_{IO}	>10^{11}	Ω
	V_{IO} =500V, T_{amb}=T_s	R_{IO}	>10^{9}	Ω
Isolation capacitance	f = 1MHz	C_{IO}	~4	pF
Safety total power dissipation	θ_{JA} = 59.2 °C/W, V_I = 5.25V, T_J = 150 °C, T_A = 25 °C	Ps	2111	mW
Safety input, output, or supply current	θ_{JA} = 59.2 °C/W, V_I = 5.25 V, T_J = 150 °C, T_A = 25 °C	Is	402	mA
Maximum safety temperature		Ts	150	°C
UL1577				
Insulation voltage per UL	V_{TEST} = V_{ISO}, t = 60 s (qualification),	V_{ISO}	5000	V_{RMS}

Description	Test Condition	Symbol	Value	Unit
	V_{TEST} = 1.2 × V_{ISO}, t = 1 s (100% production test)			



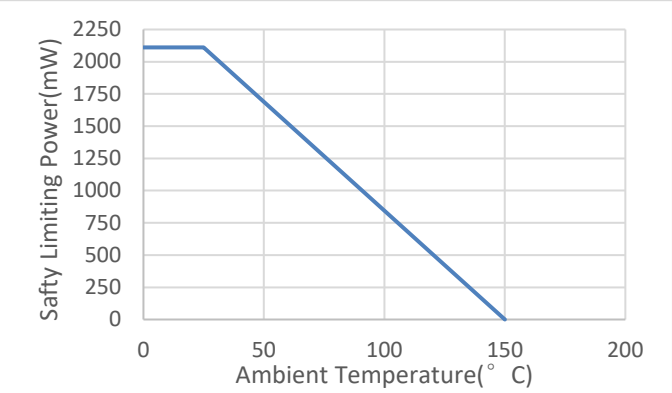


Figure 7.1 NSIP9700 Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-17

7.3. Regulatory Information

The NSIP9700 is certified with UL1577, VDE0884-17, GB4943.1, EN IEC 62368-1.

UL1577 & CSA Component Acceptance Notice 5A		DIN EN IEC 60747-17 (VDE 0884-17)	EN IEC62368-1	GB4943.1
Single Protection, 5000V_{rms} Isolation voltage	Single Protection, 5000V_{rms} Isolation voltage	Reinforced Insulation V_{IORM}=1500Vpeak V_{IOTM}=7070Vpeak	5000Vrms for 1min	Certified according to GB4943.1
Certified by UL		Certified by TUV		Certified by CQC
E500602	E500602	R50632560	R50632560	CQC20001264939

8. Function Description

8.1. Overview

The NSIP9700 is isolation DC to DC module. The isolated DC-DC converter provides up to 500mW output power using on chip transformer. The feedback PWM signal is sent to primary side by a digital isolator based on Novosense capacity isolation technology. The high integrated solution can help to simplify system design and improve reliability. The NSIP9700 is safety certified by UL1577 support 5.0kVrms withstand voltages, while providing high electromagnetic immunity and low emissions. The NSIP9700 provides 5V to 5V, 5V to 3.3V, 3.3V to 3.3V conversion mode, the output voltage can be set by SEL pin.

The high integrated solution can help to simplify system design and improve reliability. The NSIP9700 is suitable for the limited PCB space applications. NSIP9700 is also suitable for wide temperature application which the most the power module can not support.

8.2. Device Functional Modes

The NSIP9700 provides 5V to 5V, 5V to 3.3V, 3.3V to 3.3V conversion mode, the output voltage can be set by SEL pin. Supply configuration table showed below.

SEL PIN	*VDD*	*VISO*
Shorted to VISO	5V	5V
Shorted to GND2 or floating	5V	3.3V
Shorted to GND2 or floating	3.3V	3.3V

8.3. Output Short And Over Temperature Protection

The NSIP9700 is protected against output short. When the device detects the output is short, the device will be in Hiccup mode and the transfer power will be limited. So the temperature of the device will be low, and the device is protected.

The NSIP9700 is also protected against over temperature. When the device detects the chip is over 165°C, the device will be shut down until the temperature of the device is below 145°C.

9. Application Note

9.1. Typical Application

The NSIP9700 requires a 0.1 μF and 10μF bypass capacitors between VDD and GND1, VISO and GND2. The capacitor should be placed as close as possible to the package. This is very important for the performance of the device. The figure 9.1 is the basic schematic of NSIP9700.

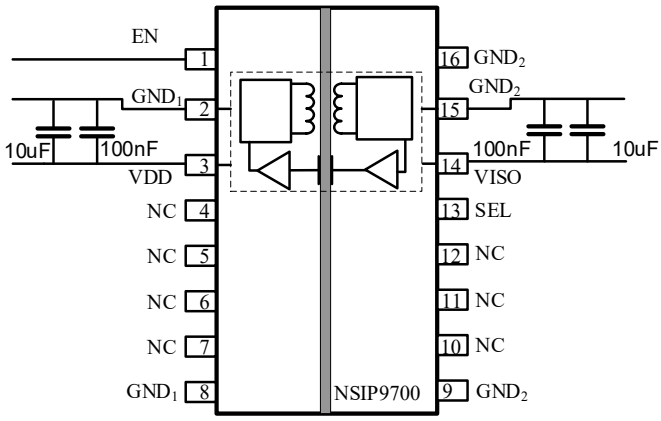


Figure 9.1 Basic schematic of NSIP9700

9.2. PCB Layout

The recommended PCB layout shown below. The low ESR capacitor C1 should be closed to PIN2 and PIN3, the distance should be less than 1mm. The low ESR capacitor C3 should be closed to PIN14 and PIN15, the distance should be less than 1mm. It is recommended that C1=C3=100nF and C2=C4=10μF.

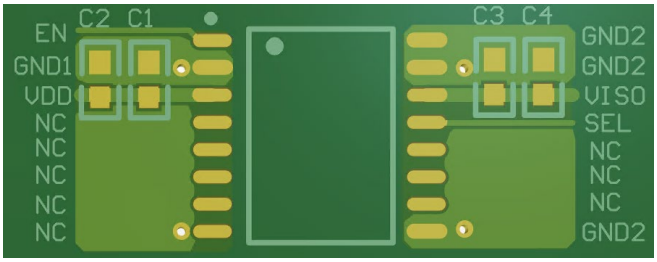


Figure 9.2 Recommended PCB Layout — Top Layer

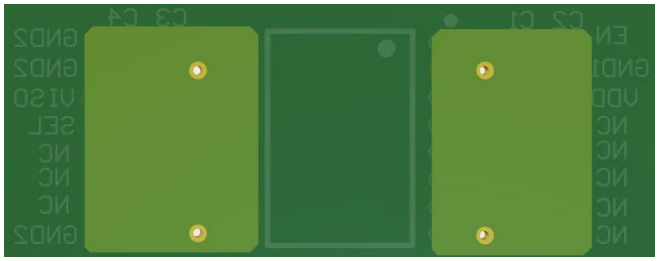
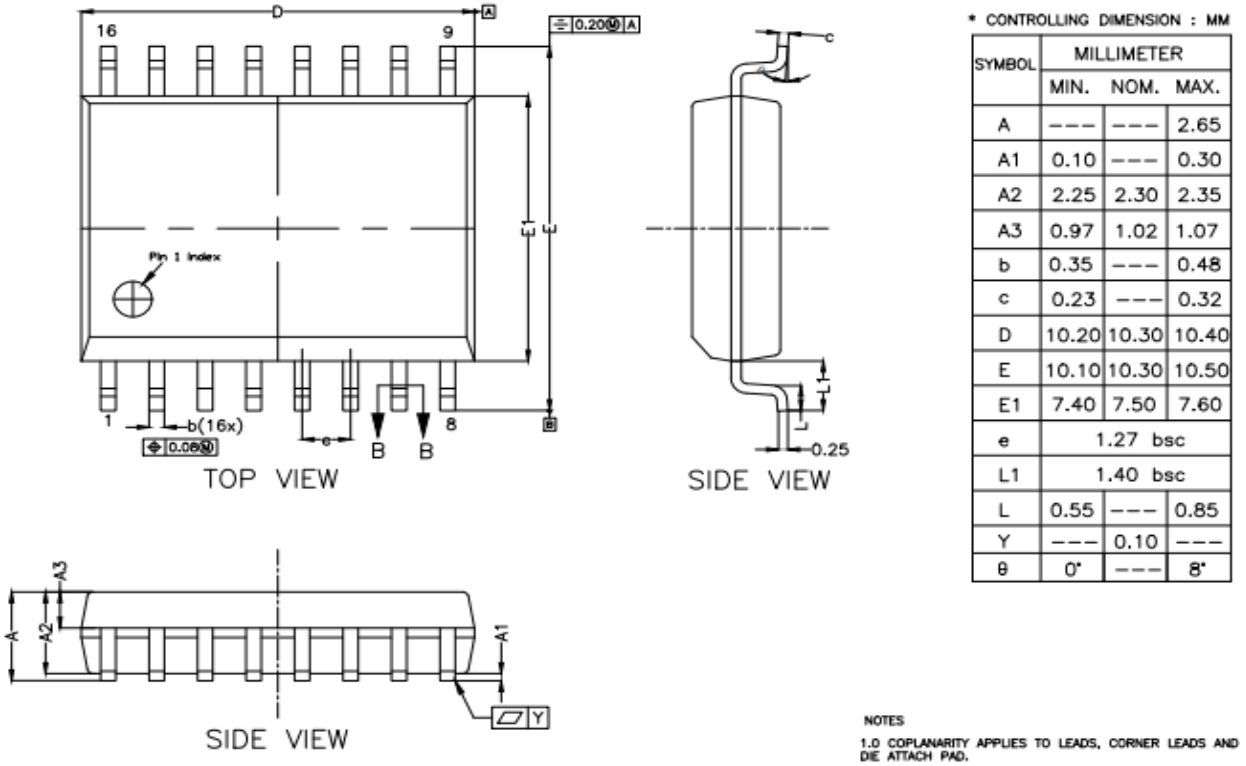


Figure 9.3 Recommended PCB Layout — Bottom Layer

10. Package Information



* CONTROLLING DIMENSION : MM

SYMBOL	MILLIMETER		
	MIN.	NOM.	MAX.
A	---	---	2.65
A1	0.10	---	0.30
A2	2.25	2.30	2.35
A3	0.97	1.02	1.07
b	0.35	---	0.48
c	0.23	---	0.32
D	10.20	10.30	10.40
E	10.10	10.30	10.50
E1	7.40	7.50	7.60
e	1.27 bsc		
L1	1.40 bsc		
L	0.55	---	0.85
Y	---	0.10	---
θ	0°	---	8°

NOTES

1.0 COPLANARITY APPLIES TO LEADS, CORNER LEADS AND DIE ATTACH PAD.

Figure 10.1 SOW16 Package Shape and Dimension in millimeters

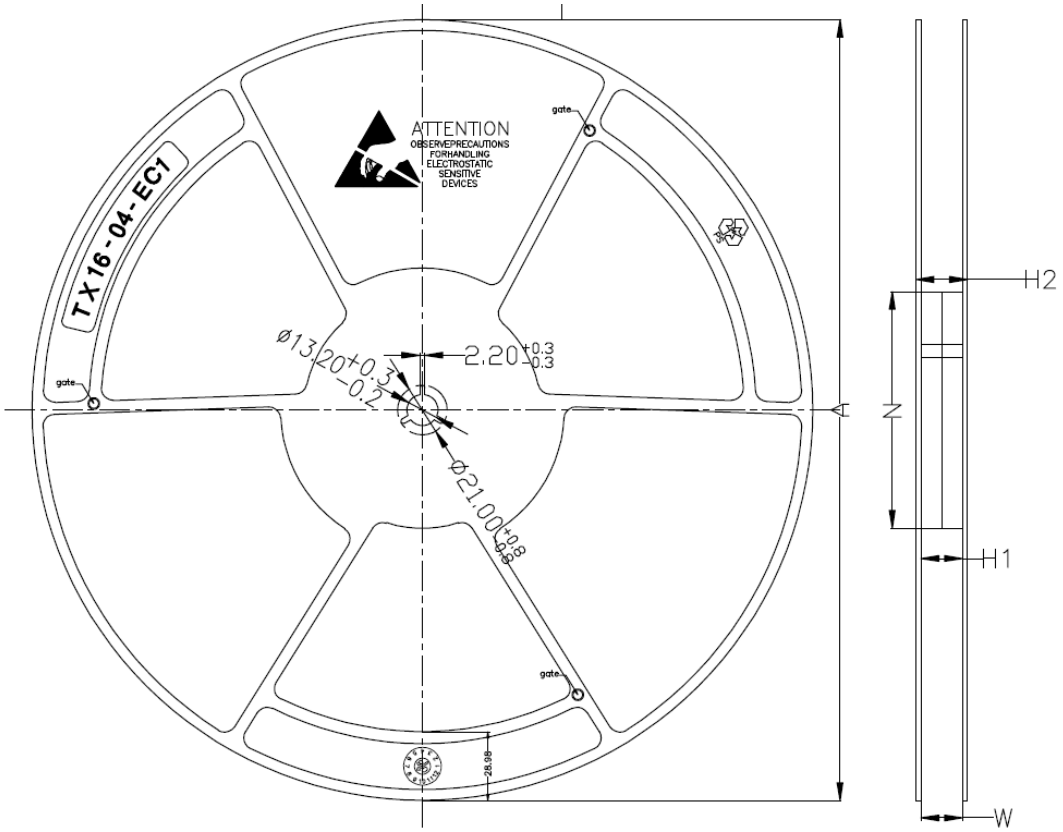
11. Order Information

Part Number	Isolation Rating (kV)	Temperature	MSL	Package Type	Package Drawing	SPQ
NSIP9700 -DSWR	5	-40 to 125°C	3	SOP16 (300mil)	SOW16	1500

12. Documentation Support

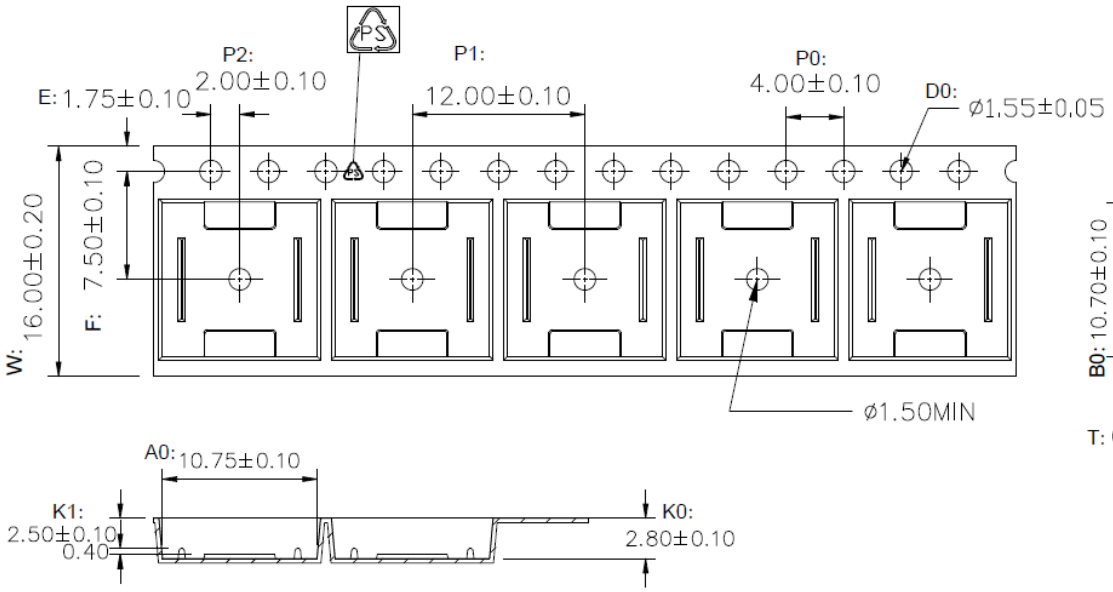
Part Number	Product Folder	Datasheet	Technical Documents	Isolator selection guide
NSIP9700	Click here	Click here	Click here	Click here

13. Tape And Reel Information



PRODUCT SPECIFICATIONS					
TAPE WIDTH	øA $^{+2}_{-2}$	øN $^{+2}_{-2}$	H1 $^{+2}_{-0}$	H2 $^{+1}_{-1}$	W $^{+3.5}_{-0.2}$
16MM	330	100	16.4	20.6	16.4

NOTES:
1.MATERIAL:DISSIPATIVE(BLACK)
2.FLANGE WARPAGE:3 MM MAXIMUM 5
3.ALL DIMENSIONS ARE IN MM
4.ESD - SURFACE RESISTIVITY-10 TO 10 OHMS/SQ
5.GENERAL TOLERANCE: ±0.25 MM



1. 10 sprocket hole pitch cumulative tolerance ±0.20 .
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy .
4. All dimensions meet EIA-481 requirements.
5. Thickness : 0.30±0.05mm.
6. Packing length per 22" reel : 378 Meters.(復卷 N=122)
7. Component load per 13" reel : 1000 pcs.
8. Surface resistivity : $10^{5} \sim 10^{10}\ \Omega/\square$

W	16.00±0.20
A0	10.75±0.10
B0	10.70±0.10
K0	2.80±0.10
K1	2.50±0.10

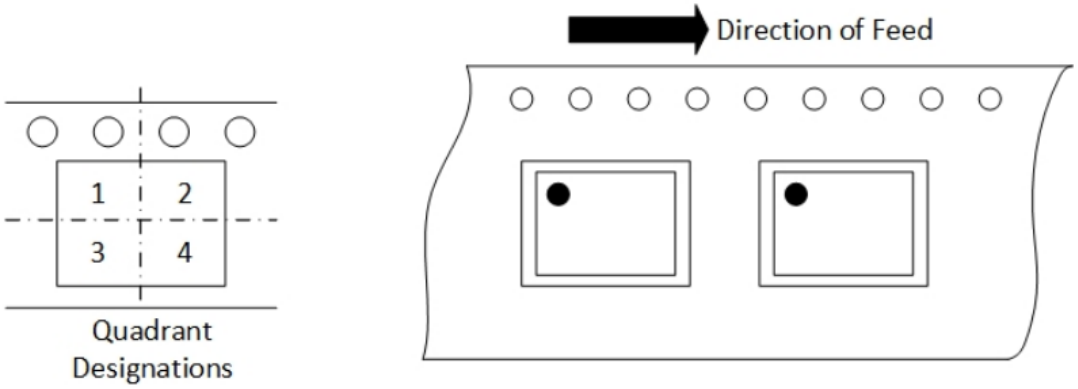


Figure 13.1 Tape and Reel Information of SOW16

14. Revision History

Revision	Description	Date
1.0	Initial version	2025/10/21

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