NOVOSENSE

NSI8210
High Reliability Single-Channel Digital Isolators
Datasheet (EN) 1.3

Product Overview

NSI8210 is a high reliability single channel digital isolator. The NSI8210 device is safety certified by UL1577 support several insulation withstand voltages (3.75kVrms, 5kVrms), while providing high electromagnetic immunity and low emissions at low power consumption. The data rate of NSI8210 is up to 150Mbps, and the common-mode transient immunity (CMTI) is up to 250kV/us. NSI8210 provides default output level configuration when the input power is lost. Wide supply voltage of NSI8210 supports to connect with most digital interface directly, easy to do the level shift. High system level EMC performance enhance reliability and stability of use. AEC-Q100 (Grade 1) option is provided for all devices.

Key Features

- Up to 5000V_{rms} Insulation voltage
- Data rate: DC to 150Mbps
- Power supply voltage: 2.5V to 5.5V
- All devices are AEC-Q100 qualified
- High CMTI: 250kV/us
- Chip level ESD: HBM: ±8kV
- Interlock function
- High system level EMC performance:
  - Enhanced system level ESD, EFT, Surge immunity
- Default output high level or low level option
- Isolation surge voltage: >10kV
- Low power consumption: 1.5mA/ch (1 Mbps)
- Low propagation delay: <15ns
- Operation temperature: -40℃~125℃
- RoHS-compliant packages:
  - SOP8 narrow body
  - SOW8 wide body
  - SOW16 wide body

Safety Regulatory Approvals

- UL recognition: up to 5000V_{rms} for 1 minute per UL1577
- CQC certification per GB4943.1
- CSA component notice 5A
- DIN EN IEC 60747-17 (VDE 0884-17)

Applications

- Industrial automation system
- Isolated SPI, RS232, RS485
- General-purpose multichannel isolation
- Motor Control
- For automotive application

Device Information

Part Number	*Package*	*Body Size*
NSI8210Nx-XSPR	SOP8	4.90mm × 3.90mm
NSI8210Wx-XSWVR	SOW8	5.85mm × 7.50mm
NSI8210Wx-XSWR	SOW16	10.30mm × 7.50mm

Functional Block Diagrams

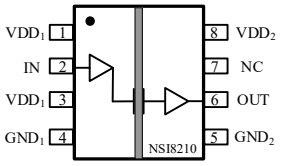


Figure 1. NSI8210Nx-XSPR Block Diagram

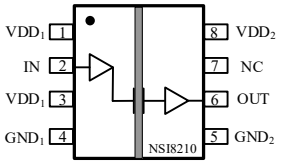


Figure 2. NSI8210Wx-XSWVR Block Diagram

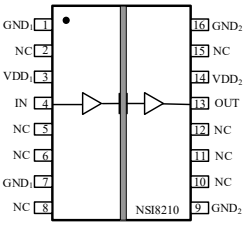


Figure 3. NSI8210Wx-XSWR Block Diagram

INDEX

1. PIN CONFIGURATION AND FUNCTIONS 3
2. ABSOLUTE MAXIMUM RATINGS 6
3. RECOMMENDED OPERATING CONDITIONS 6
4. THERMAL INFORMATION 7
5. SPECIFICATIONS 7
5.1. Electrical Characteristics 7
5.2. Supply Current Characteristics – 5V 8
5.3. Supply Current Characteristics – 3.3V 8
5.4. Supply Current Characteristics – 2.5V 9
5.5. Switching Characteristics – 5V 9
5.6. Switching Characteristics – 3.3V 10
5.7. Switching Characteristics – 2.5V 10
5.8. Typical Performance Characteristics 11
5.9. Parameter Measurement Information 11
6. HIGH VOLTAGE FEATURE DESCRIPTION 13
6.1. Insulation and Safety Related Specifications 13
6.2. Insulation Characteristics 13
6.3. Safety-Limiting Values 15
6.4. Regulatory Information 17
7. FUNCTION DESCRIPTION 19
7.1. Overview 19
7.2. OOK Modulation 20
8. APPLICATION NOTE 21
8.1. Typical Application Circuit 21
8.2. PCB Layout 21
8.3. High Speed Performance 22
8.4. Typical Supply Current Equations 22
9. PACKAGE INFORMATION 23
10. ORDERING INFORMATION 26
11. DOCUMENTATION SUPPORT 27
12. TAPE AND REEL INFORMATION 28
13. REVISION HISTORY 32

1. Pin Configuration and Functions

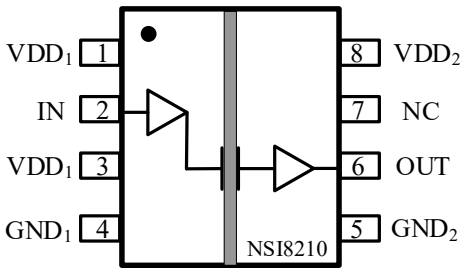


Figure 1.1 NSI8210N Package

Table 1.1 NSI8210N Pin Configuration and Description

NSI8210N PIN NO.	*SYMBOL*	*FUNCTION*
1	VDD1	Power Supply for Isolator Side 1
2	IN	Logic Input
3	VDD1	Power Supply for Isolator Side 1
4	GND1	Ground 1, the ground reference for Isolator Side 1
5	GND2	Ground 2, the ground reference for Isolator Side 2
6	OUT	Logic Output
7	NC	Not connect pin; it has no internal connection
8	VDD2	Power Supply for Isolator Side 2

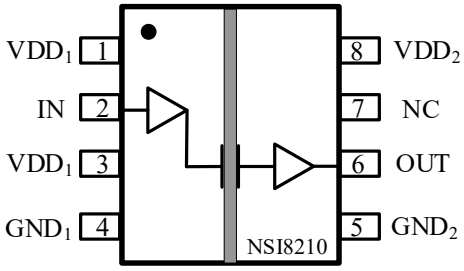


Figure 1.2 NSI8210W SOW8 Package

Table 1.2 NSI8210W SOW8 Pin Configuration and Description

NSI8210W PIN NO.	*SYMBOL*	*FUNCTION*
1	VDD1	Power Supply for Isolator Side 1
2	IN	Logic Input
3	VDD1	Power Supply for Isolator Side 1
4	GND1	Ground 1, the ground reference for Isolator Side 1
5	GND2	Ground 2, the ground reference for Isolator Side 2
6	OUT	Logic Output
7	NC	Not connect pin; it has no internal connection
8	VDD2	Power Supply for Isolator Side 2

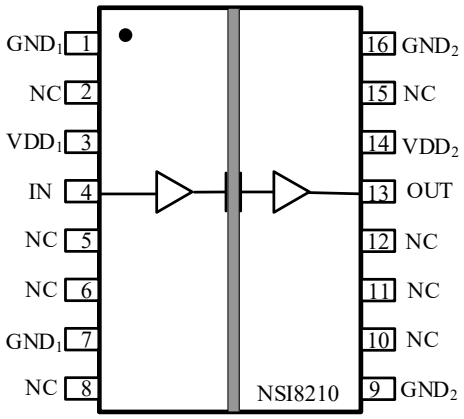


Figure 1.3 NSI8210W SOW16 Package

Table 1.3 NSI8210W SOW16 Pin Configuration and Description

NSI8210W PIN NO.	*SYMBOL*	*FUNCTION*
1	GND1	Ground 1, the ground reference for Isolator Side 1
2	NC	Not connect pin; it has no internal connection
3	VDD1	Power Supply for Isolator Side 1
4	IN	Logic Input
5	NC	Not connect pin; it has no internal connection
6	NC	Not connect pin; it has no internal connection
7	GND1	Ground 1, the ground reference for Isolator Side 1
8	NC	Not connect pin; it has no internal connection
9	GND2	Ground 2, the ground reference for Isolator Side 2
10	NC	Not connect pin; it has no internal connection
11	NC	Not connect pin; it has no internal connection
12	NC	Not connect pin; it has no internal connection
13	OUT	Logic Output
14	VDD2	Power Supply for Isolator Side 2
15	NC	Not connect pin; it has no internal connection
16	GND2	Ground 2, the ground reference for Isolator Side 2

2. Absolute Maximum Ratings

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	VDD1, VDD2	-0.5		6.5	V	
Maximum Input Voltage	IN	-0.4		VDD+0.4	V	The maximum voltage must not exceed 6.5V
Maximum Output Voltage	OUT	-0.4		VDD+0.4	V	The maximum voltage must not exceed 6.5V
Maximum Input/Output Pulse Voltage	IN, OUT	-0.8		VDD+0.8	V	Pulse width should be less than 100ns, and the duty cycle should be less than 10%
Output current	I_O	-15		15	mA	
Operating Temperature	T_{opr}	-40		125	℃	
Junction Temperature	T_J	-40		150	℃	
Storage Temperature	T_{stg}	-65		150	℃	
Electrostatic discharge	HBM			±8000	V	
	CDM			±2000	V	

3. Recommended Operating Conditions

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	VDD1, VDD2	2.5		5.5	V	
High-level Input Voltage	VIH	2			V	
Low-level Input Voltage	VIL			0.8	V	
Data Rate	DR	0		150	Mbps	
Operating Temperature	T_{opr}	-40		125	℃	

4. Thermal Information

Parameters	Symbol	SOW16	SOW8	SOP8	Unit
IC Junction-to-Air Thermal Resistance	θ_{JA}	94.4	84.3	146.1	°C/W
Junction-to-case (top) thermal resistance	$\theta_{JC(top)}$	57.3	36.3	63.1	°C/W
Junction-to-board thermal resistance	θ_{JB}	57.1	47.0	80.0	°C/W

5. Specifications

5.1. Electrical Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power on Reset	VDD_{POR}	2	2.2	2.4	V	POR threshold as during power-up
	VDD_{HYS}		0.1		V	POR threshold Hysteresis
Rising input switching threshold	V_{IT+}		1.6	2	V	
Falling input switching threshold	V_{IT-}	0.8	1.2		V	
Input threshold voltage hysteresis	$V_{I(HYS)}$		0.4		V	
High Level Output Voltage	V_{OH}	VDD-0.4			V	I_{OH} =- 4mA
Low Level Output Voltage	V_{OL}			0.4	V	I_{OL} = 4mA
Output Impedance	R_{out}		50		ohm	
Input Pull high or low Current	I_{pull}		8	15	uA	
Start Up Time after POR	t_{rbs}		10		usec	
Common Mode Transient Immunity	CMTI	±200	±250		kV/us	See Figure 5.6 , C_L = 15pF

5.2. Supply Current Characteristics – 5V

(VDD1=VDD2=5V ± 10%, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at **VDD1=VDD2=5V,** Ta = 25℃)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Supply current	IDD1(Q0)		0.64	0.96	mA	All Input 0V for NSI8210N0 or All Input at supply for NSI8210N1
	IDD2(Q0)		1.27	1.91	mA	
	IDD1(Q1)		1.66	2.49	mA	All Input at supply for NSI8210N0 or All Input 0V for NSI8210N1
	IDD2(Q1)		1.28	1.92	mA	
	IDD1(1M)		1.16	1.74	mA	All Input with 1Mbps, CL=15pF
	IDD2(1M)		1.33	2.00	mA	
	IDD1(10M)		1.17	1.76	mA	All Input with 10Mbps, CL=15pF
	IDD2(10M)		1.78	2.67	mA	
	IDD1(100M)		1.34	2.01	mA	All Input with 100Mbps, CL=15pF
	IDD2(100M)		6.16	9.24	mA	

5.3. Supply Current Characteristics – 3.3V

(VDD1=VDD2=3.3V ± 10%, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at **VDD1=VDD2=3.3V,** Ta = 25℃)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Supply current	IDD1(Q0)		0.6	0.9	mA	All Input 0V for NSI8210N0 or All Input at supply for NSI8210N1
	IDD2(Q0)		1.22	1.83	mA	
	IDD1(Q1)		1.62	2.43	mA	All Input at supply for NSI8210N0 or All Input 0V for NSI8210N1
	IDD2(Q1)		1.23	1.85	mA	
	IDD1(1M)		1.11	1.67	mA	All Input with 1Mbps, CL=15pF
	IDD2(1M)		1.26	1.89	mA	
	IDD1(10M)		1.12	1.68	mA	All Input with 10Mbps, CL=15pF
	IDD2(10M)		1.56	2.34	mA	
	IDD1(100M)		1.17	1.76	mA	All Input with 100Mbps, CL=15pF
	IDD2(100M)		4.48	6.72	mA	

5.4. Supply Current Characteristics – 2.5V

(VDD1=VDD2=2.5V ± 10%, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at **VDD1=VDD2=2.5V,** Ta = 25℃)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Supply current	IDD1(Q0)		0.58	0.87	mA	All Input 0V for NSI8210N0 or All Input at supply for NSI8210N1
	IDD2(Q0)		1.2	1.8	mA	
	IDD1(Q1)		1.6	2.4	mA	All Input at supply for NSI8210N0 or All Input 0V for NSI8210N1
	IDD2(Q1)		1.2	1.8	mA	
	IDD1(1M)		1.09	1.64	mA	All Input with 1Mbps, CL=15pF
	IDD2(1M)		1.23	1.85	mA	
	IDD1(10M)		1.10	1.65	mA	All Input with 10Mbps, CL=15pF
	IDD2(10M)		1.46	2.19	mA	
	IDD1(100M)		1.07	1.61	mA	All Input with 100Mbps, CL=15pF
	IDD2(100M)		3.72	5.58	mA	

5.5. Switching Characteristics – 5V

(VDD1=5V± 10%, VDD2=5V± 10%, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at **VDD1 = 5V, VDD2 = 5V,** Ta = 25℃)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Data Rate	DR	0		150	Mbps	
Minimum Pulse Width	PW			5.0	ns	
Propagation Delay	t_{PLH}	2.5	6.54	15	ns	See Figure 5.5 , C_L = 15pF
	t_{PHL}	2.5	8.30	15	ns	See Figure 5.5 , C_L = 15pF
Pulse Width Distortion $\lvert t_{PHL} - t_{PLH} \rvert$	PWD			5.0	ns	See Figure 5.5 , C_L = 15pF
Rising Time	t_r			5.0	ns	See Figure 5.5 , C_L = 15pF
Falling Time	t_f			5.0	ns	See Figure 5.5 , C_L = 15pF
Peak Eye Diagram Jitter	t_{JIT}(PK)		350		ps	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	

5.6. Switching Characteristics – 3.3V

(VDD1=3.3V± 10%, VDD2=3.3V± 10%, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at **VDD1 = 3.3V, VDD2 = 3.3V,** Ta = 25℃)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Data Rate	DR	0		150	Mbps	
Minimum Pulse Width	PW			5.0	ns	
Propagation Delay	t_{PLH}	2.5	8.0	15	ns	See Figure 5.5 , C_L = 15pF
	t_{PHL}	2.5	8.7	15	ns	See Figure 5.5 , C_L = 15pF
Pulse Width Distortion $\lvert t_{PHL} - t_{PLH} \rvert$	PWD			5.0	ns	See Figure 5.5 , C_L = 15pF
Rising Time	t_r			5.0	ns	See Figure 5.5 , C_L = 15pF
Falling Time	t_f			5.0	ns	See Figure 5.5 , C_L = 15pF
Peak Eye Diagram Jitter	t_{JIT}(PK)		350		ps	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	

5.7. Switching Characteristics – 2.5V

(VDD1=2.5V± 10%, VDD2=2.5V± 10%, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at **VDD1 = 2.5V, VDD2 = 2.5V,** Ta = 25℃)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Data Rate	DR	0		150	Mbps	
Minimum Pulse Width	PW			5.0	ns	
Propagation Delay	t_{PLH}	2.5	9.0	15	ns	See Figure 5.5 , C_L = 15pF
	t_{PHL}	2.5	9.3	15	ns	See Figure 5.5 , C_L = 15pF
Pulse Width Distortion $\lvert t_{PHL} - t_{PLH} \rvert$	PWD			5.0	ns	See Figure 5.5 , C_L = 15pF
Rising Time	t_r			5.0	ns	See Figure 5.5, C_L = 15pF
Falling Time	t_f			5.0	ns	See Figure 5.5, C_L = 15pF
Peak Eye Diagram Jitter	t_{JIT}(PK)		350		ps	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	

5.8. Typical Performance Characteristics

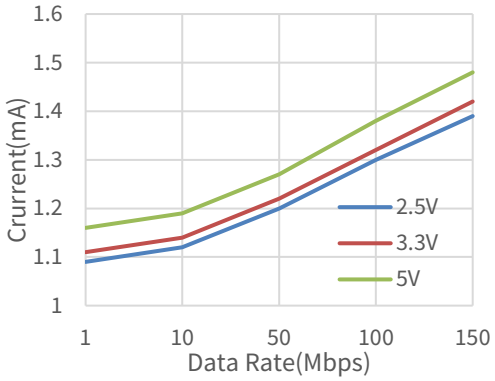


Figure 5.1 NSI8210 VDD1 Supply Current vs Data Rate

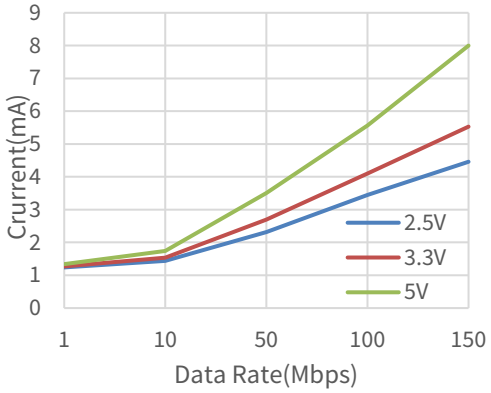


Figure 5.2 NSI8210 VDD2 Supply Current vs Data Rate

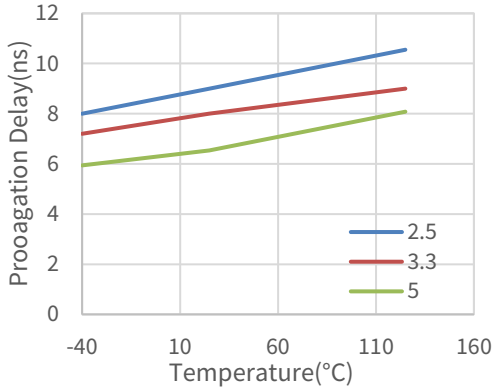


Figure 5.3 Rising Edge Propagation Delay Vs Temp

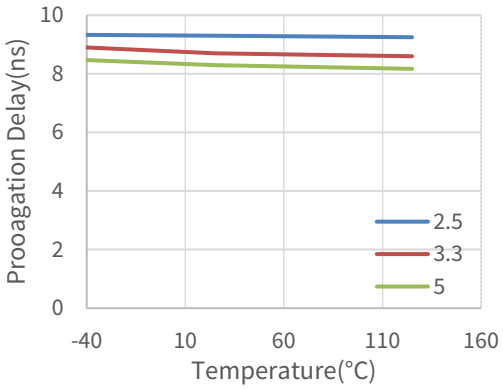


Figure 5.4 Falling Edge Propagation Delay Vs Temp

5.9. Parameter Measurement Information

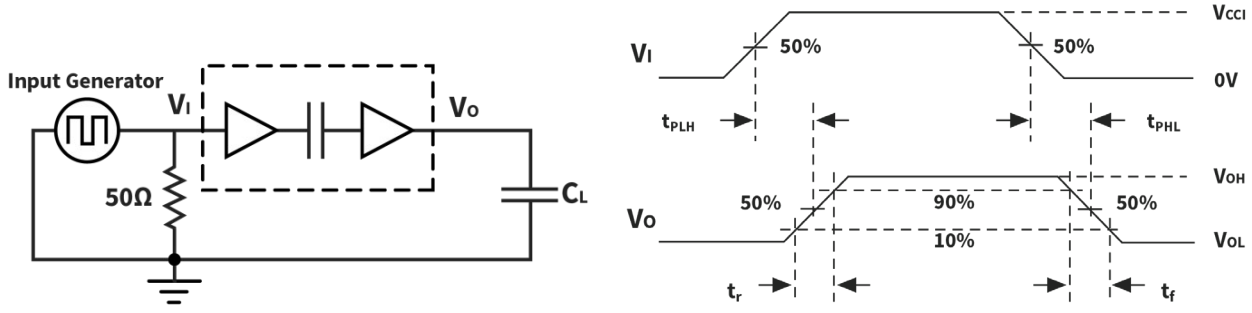


Figure 5.5 Switching Characteristics Test Circuit and Waveform

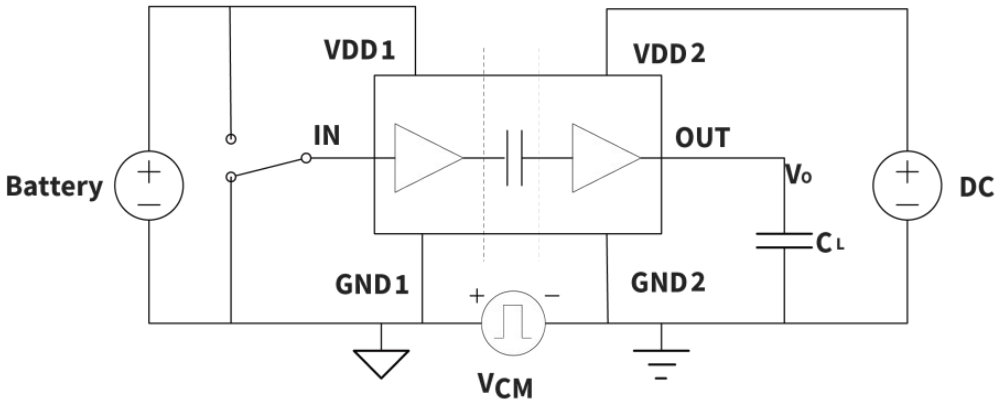


Figure 5.6 Common-Mode Transient Immunity Test Circuit

6. High Voltage Feature Description

6.1. Insulation and Safety Related Specifications

Parameters	Symbol	Value			Unit	Comments
		SOP8	SOW8	SOW16		
Minimum External Clearance	CLR	4.0	8.0	8.0	mm	IEC 60664-1:2007
Minimum External Creepage	CPG	4.0	8.0	8.0	mm	IEC 60664-1:2007
Distance Through Insulation	DTI	28			um	
Tracking Resistance (Comparative Tracking Index)	CTI	>600	>600	>600	V	DIN EN 60112 (VDE 0303-11); IEC 60112
Material Group		Ⅰ	Ⅰ	Ⅰ		IEC 60664-1

Description	Test Condition	Value		
		SOP8	SOW8	SOW16
Overvoltage Category per IEC60664-1	For Rated Mains Voltage ≤ 150Vrms	Ⅰ to Ⅳ	Ⅰ to Ⅳ	Ⅰ to Ⅳ
	For Rated Mains Voltage ≤ 300Vrms	Ⅰ to Ⅲ	Ⅰ to Ⅳ	Ⅰ to Ⅳ
	For Rated Mains Voltage ≤ 600Vrms	Ⅰ to Ⅱ	Ⅰ to Ⅳ	Ⅰ to Ⅳ
	For Rated Mains Voltage ≤ 1000Vrms	Ⅰ	Ⅰ to Ⅲ	Ⅰ to Ⅲ
Climatic Classification		40/125/21		
Pollution Degree per DIN VDE 0110,		2		

6.2. Insulation Characteristics

Description	Test Condition	Symbol	Value			Unit
			SOP8	SOW8	SOW16	
Maximum repetitive isolation voltage		V_{IORM}	565	2121	2121	V_{PEAK}
Maximum Working Isolation Voltage	AC voltage	V_{IOWM}	400	1500	1500	V_{RMS}
	DC voltage		565	2121	2121	V_{DC}

Description	Test Condition	Symbol	Value			Unit
			SOP8	SOW8	SOW16	
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	<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
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 ,$V_{pd(m)}$=1.3*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 $V_{pd\ (m)}$=1.5*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}	5300	8000	8000	V_{PEAK}
Maximum impulse voltage	Tested in air, 1.2/50-us waveform per IEC62368-1	V_{IMP}	5384	6250	6250	V_{PEAK}
Maximum Surge Isolation Voltage	Test method per IEC60065,1.2/50us waveform, V_{IOSM}≥V_{IMP} × 1.3	V_{IOSM}	7000	10000	10000	V_{PEAK}
Isolation resistance	V_{IO} =500V, T_{amb}=25℃	R_{IO}	>10^{12}	>10^{12}	>10^{12}	Ω

Description	Test Condition	Symbol	Value			Unit
			SOP8	SOW8	SOW16	
	V_{IO} =500V, 100℃ ≤ T_{amb} ≤ 125℃		>10^{11}	>10^{11}	>10^{11}	Ω
	V_{IO} =500V, T_{amb}=T_s		>10^{9}	>10^{9}	>10^{9}	Ω
Isolation capacitance	f = 1MHz	C_{IO}	0.6	0.6	0.6	pF
UL1577						
Withstand Isolation Voltage	V_{TEST} = V_{ISO}, t = 60 s (qualification), V_{TEST} = 1.2 × V_{ISO}, t = 1 s (100% production test)	V_{ISO}	3750	5000	5000	V_{RMS}

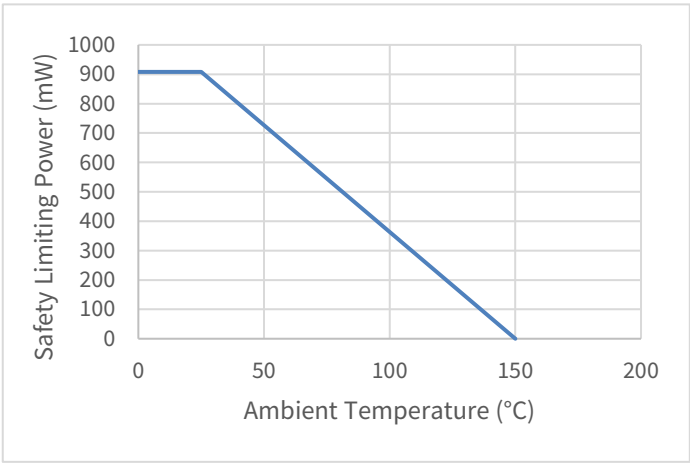
6.3. Safety-Limiting Values

Basic isolation safety-limiting values as outlined in VDE-0884-17 of NSI8210N-DSPR SOP8(150mil)

Description	Test Condition	Value	Unit
Safety Supply Power	$R_{θJA}$ = 137.7 ℃/W, T J = 150 ℃, T A = 25 ℃	908	mW
Safety Supply Current	$R_{θJA}$ = 137.7 ℃/W, V I = 5.5 V, T J = 150 ℃, T A = 25 ℃	165	mA
Safety Temperature[2)]		150	°C

1) Calculate with the junction-to-air thermal resistance, $R_{θJA}$, of SOP8(150mil) package (***Thermal Information Table***) which is that of a device installed on a low effective thermal conductivity test board (1s) according to JESD51-3.

2) The maximum safety temperature has the same value as the maximum junction temperature (T_J) specified for the device.



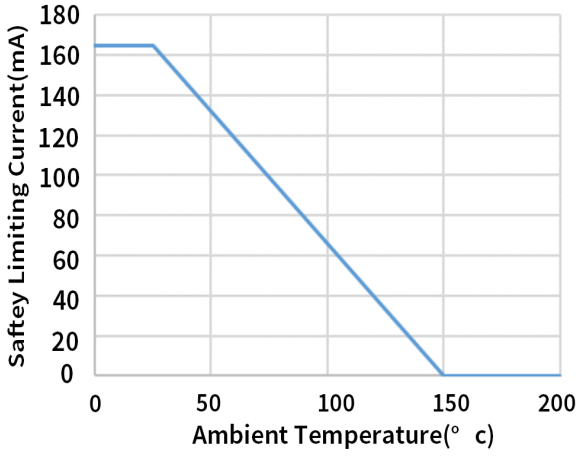


Figure 6.1 NSI8210N-DSPR Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-17

Reinforced isolation safety-limiting values as outlined in VDE-0884-17 of NSI8210W-DSWVR SOW8(300mil)

Description	Test Condition	Value	Unit
Safety Supply Power	$R_{\theta JA}$ = 84.3 ℃/W, V I = 5.5 V, T J = 150 ℃, T A = 25 ℃	1483	mW
Safety Supply Current	$R_{\theta JA}$ = 84.3 ℃/W, T J = 150 ℃, T A = 25 ℃	269.6	mA
Safety Temperature[2)]		150	°C

1) Calculate with the junction-to-air thermal resistance, $R_{\theta JA}$, of SOW8(300mil) package (***Thermal Information Table***) which is that of a device installed on a low effective thermal conductivity test board (1s) according to JESD51-3.

2) The maximum safety temperature has the same value as the maximum junction temperature (T_J) specified for the device.

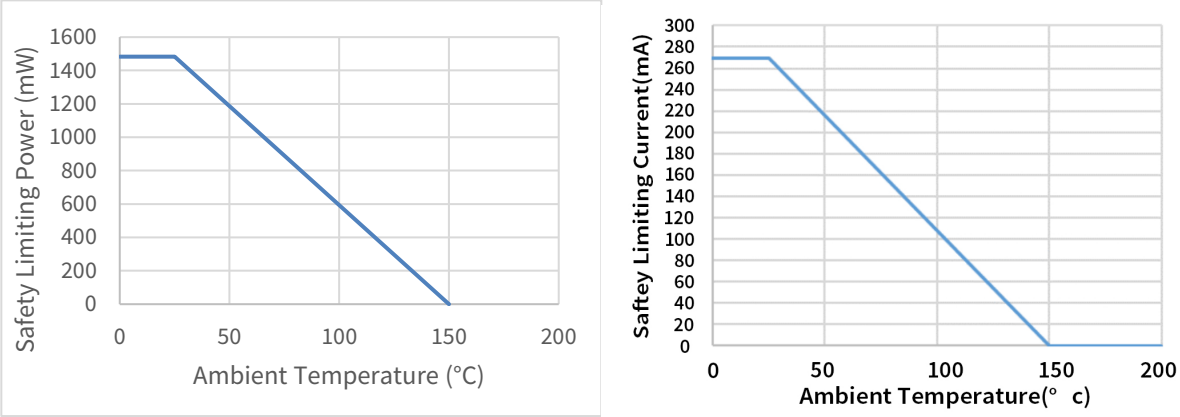


Figure 6.2 NSI8210W-DSWVR Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-17

Reinforced isolation safety-limiting values as outlined in VDE-0884-17 of NSI8210W-DSWR SOW16(300mil)

Description	Test Condition	Value	Unit
Safety Supply Power	$R_{\theta JA}$ = 86.5 ℃/W, V I = 5.5 V, T J = 150 ℃, T A = 25 ℃	1445	mW
Safety Supply Current	$R_{\theta JA}$ = 86.5 ℃/W, T J = 150 ℃, T A = 25 ℃	262.7	mA
Safety Temperature[2)]		150	°C

1) Calculate with the junction-to-air thermal resistance, $R_{\theta JA}$, of SOW16(300mil) package (***Thermal Information Table***) which is that of a device installed on a low effective thermal conductivity test board (1s) according to JESD51-3.

2) The maximum safety temperature has the same value as the maximum junction temperature (T_J) specified for the device.

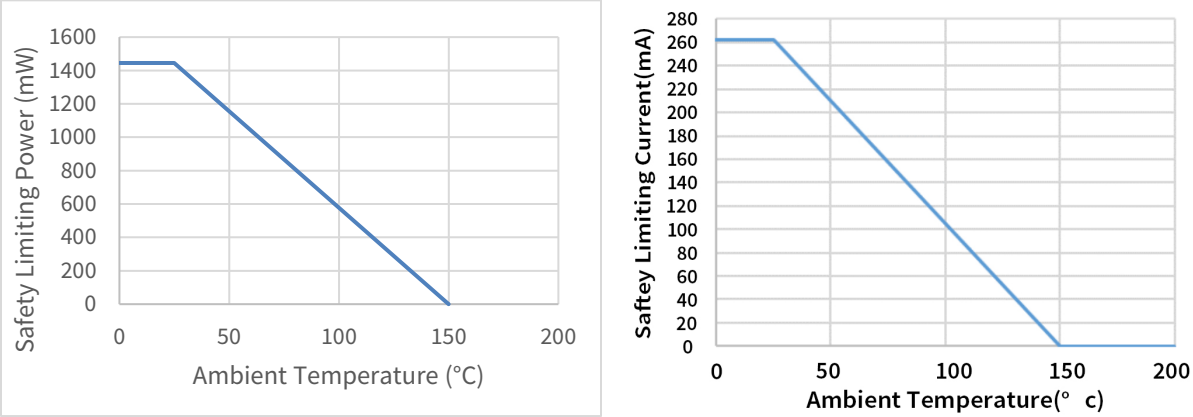


Figure 6.3 NSI8210W-DSWR Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-17

6.4. Regulatory Information

The NSI8210N-DSPR are approved by the organizations listed in table.

CUL		VDE	CQC	TUV
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to GB4943.1	Certified According to EN IEC 62368-1
Single Protection, 3750V_{rms} Isolation voltage	Single Protection, 3750V_{rms} Isolation voltage	Basic Insulation V_{IORM}=565Vpeak V_{IOTM}=5300Vpeak V_{IOSM}=7000Vpeak	Basic insulation	3000Vrms for 1min
File (E500602)	File (E500602)	File (40050121)	File (CQC20001264940)	R50574061

The NSI8210W-DSWVR are approved by the organizations listed in table.

CUL		VDE	CQC	TUV
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to GB4943.1	Certified According to EN IEC 62368-1
Single Protection, 5000V_{rms} Isolation voltage	Single Protection, 5000V_{rms} Isolation voltage	Reinforced Insulation V_{IORM}=2121Vpeak V_{IOTM}=8000Vpeak V_{IOSM}=10000Vpeak	Reinforced insulation	5000Vrms for 1min
File (E500602)	File (E500602)	File (40052820)	File (CQC20001264938)	R50574061

The NSI8210W-DSWR are approved by the organizations listed in table.

CUL		VDE	CQC	TUV
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to GB4943.1	Certified According to EN IEC 62368-1
Single Protection, 5000V_{rms} Isolation voltage	Single Protection, 5000V_{rms} Isolation voltage	Reinforced Insulation V_{IORM}=2121Vpeak V_{IOTM}=8000Vpeak V_{IOSM}=10000Vpeak	Reinforced insulation	5000Vrms for 1min
File (E500602)	File (E500602)	File (40052820)	File (CQC20001264939)	R50574061

7. Function Description

7.1. Overview

The NSI8210 is a single-channel digital isolator based on a capacitive isolation barrier technique. The digital signal is modulated with RF carrier generated by the internal oscillator at the Transmitter side. Then it is transferred through the capacitive isolation barrier and demodulated at the Receiver side.

NSI8210 is a high reliability single channel digital isolator with AEC-Q100(Grade 1) qualified, it's certified by UL1577 and support 3.75kVrms insulation withstand voltage, while providing high electromagnetic immunity and low emissions at low power consumption. The data rate of NSI8210 is up to 150Mbps, and the common-mode transient immunity (CMTI) is up to 250kV/us. NSI8210 provides default output level configuration when the input power is lost. Wide supply voltage of NSI8210 supports to connect with most digital interface directly, easy to do the level shift.

NSI8210 has a default output status when VDDIN is unready and VDDOUT is ready as shown in Table 7.1, which helps for diagnosis when power is missing at the transmitter side. The other outputs follow the same status with the input A within 1us after powering up respectively.

Table 7.1 Output status vs. power status with interlock function

Input	*VDD1 status*	*VDD2 status*	*Output*	*Comment*
H[1]	Ready	Ready	H	Normal operation.
L[2]	Ready	Ready	L	
X[3]	Unready	Ready	L(NSI8210x0) H(NSI8210x1)	The output follows the same status with the input within 20us after input side VDD1 is powered on.
X	Ready	Unready	X	The output follows the same status with the input within 20us after output side VDD2 is powered on.
Note: [1]H=Logic high; [2]L=Logic low; [3]X=Logic low or logic high				

7.2. OOK Modulation

NSI8210 is based on a capacitive isolation barrier technique and the digital signal is modulated with RF carrier generated by the internal oscillator at the transmitter side, as shown in Figure 7.1 & Figure 7.2, then it is transferred through the capacitive isolation barrier and demodulated at the receiver side. The modulation uses OOK modulation technique with key benefits of high noise immunity and low radiation EMI.

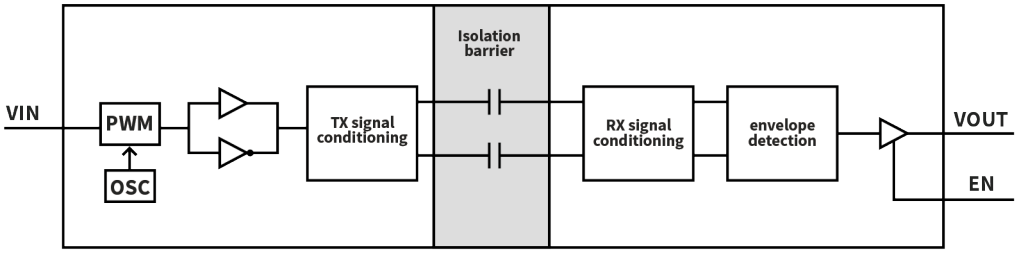


Figure 7.1 Single Channel Function Block Diagram

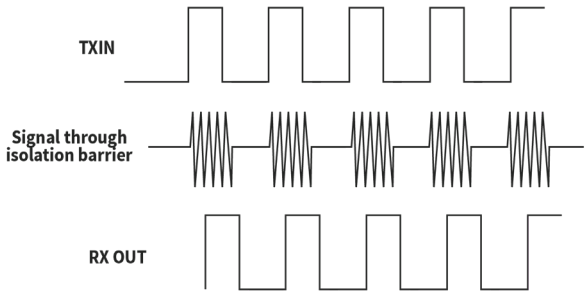


Figure 7.2 OOK Modulation

8. Application Note

8.1. Typical Application Circuit

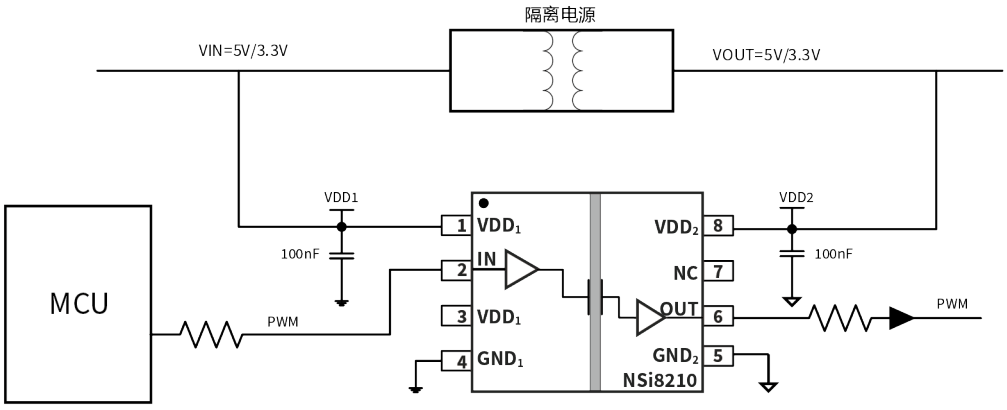


Figure 8.1 Typical PWM isolation circuit

8.2. PCB Layout

NSI8210 requires a 0.1 μF bypass capacitor between VDD1 and GND1, VDD2 and GND2. The capacitor should be placed as close as possible to the package. Figure 8.2 to Figure 8.3 show the recommended PCB layout, make sure the space under the chip should keep free from planes, traces, pads and via. To enhance the robustness of a design, the user may also include resistors (50–300 Ω) in series with the inputs and outputs if the system is excessively noisy. The series resistors also improve the system reliability such as latch-up immunity.

The typical output impedance of an isolator driver channel is approximately 50Ω, ±40%. When driving loads where transmission line effects will be a factor, output pins should be appropriately terminated with controlled impedance PCB traces.

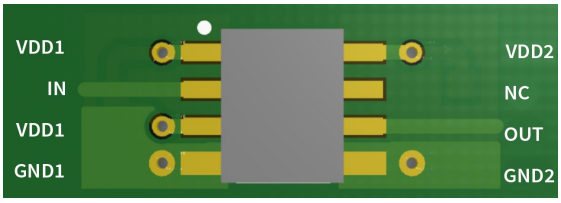


Figure8.2 Recommended PCB Layout — Top Layer

Figure8.3 Recommended PCB Layout — Bottom Layer

8.3. High Speed Performance

Figure 8.6 shows the eye diagram of NSI8210 at 50Mbps data rate output. The result shows a typical measurement on NSI8210 with low jitter and wide open eye characteristics.

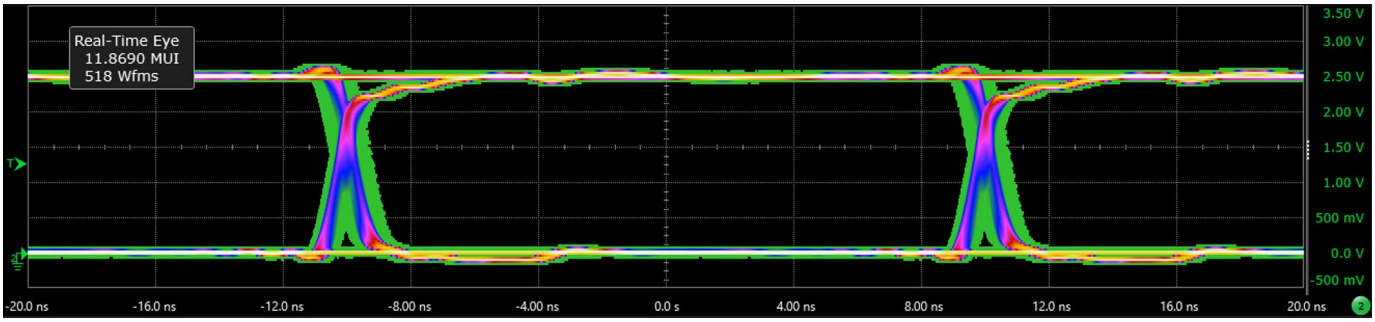


Figure 8.6 Eye Diagram at 50Mbps PRBS 2^{16}-1, 2.5V and 25℃

Figure 8.4 Eye diagram

8.4. Typical Supply Current Equations

The typical supply current of NSI8210 can be calculated using below equations. I_{DD1} and I_{DD2} are typical supply currents measured in mA, f is data rate measured in Mbps, C_L is the capacitive load measured in pF

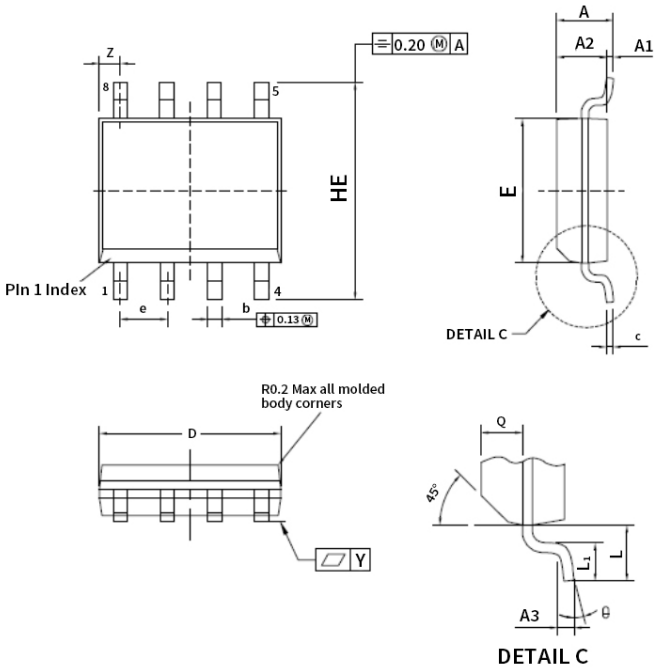
NSI8210:

I_{DD1} = 0.6 *a1+1.25*b1+1.1*c1.

I_{DD2} = 0.9 *a1+1.85*b1+VDD2*f* C_L *c1*10^{-9}

Where a1 is the channel number of default state inputs at side 1, b1 is the channel number of non-default state inputs at side 1, c1 is the channel number of switch signal inputs at side 1.

9. Package Information

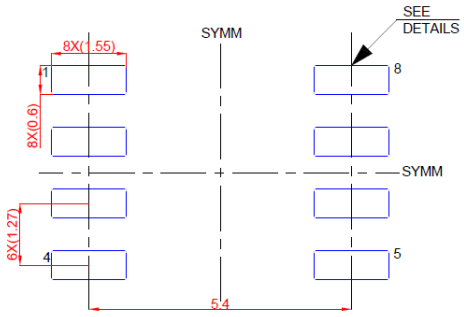


* CONTROLLING DIMENSION:MM

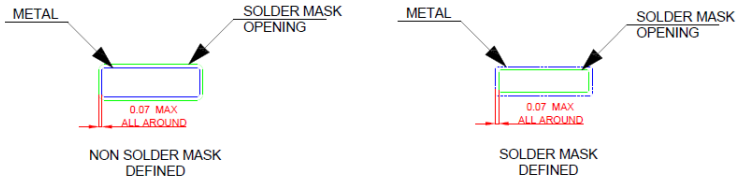
SYMBOL	MILLIMETER		
	MIN.	NOM.	MAX.
A	---	---	1.75
A1	0.10	---	0.25
A2	1.25	1.35	1.45
b	0.33	0.38	0.49
c	0.19	0.20	0.25
D	4.80	4.90	5.00
E	3.80	3.90	4.00
Q	0.60	0.65	0.70
HE	5.80	6.00	6.20
e	1.27 BSC		
L	1.05 BSC		
L1	0.40	0.64	1.00
Y	---	0.10	---
Z	0.3	0.5	0.7
A3	0.25 BSC		
θ	0°	5°	8°

NOTE: This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.

Figure 9.1 SOP8 Package Shape and Dimension in millimeters

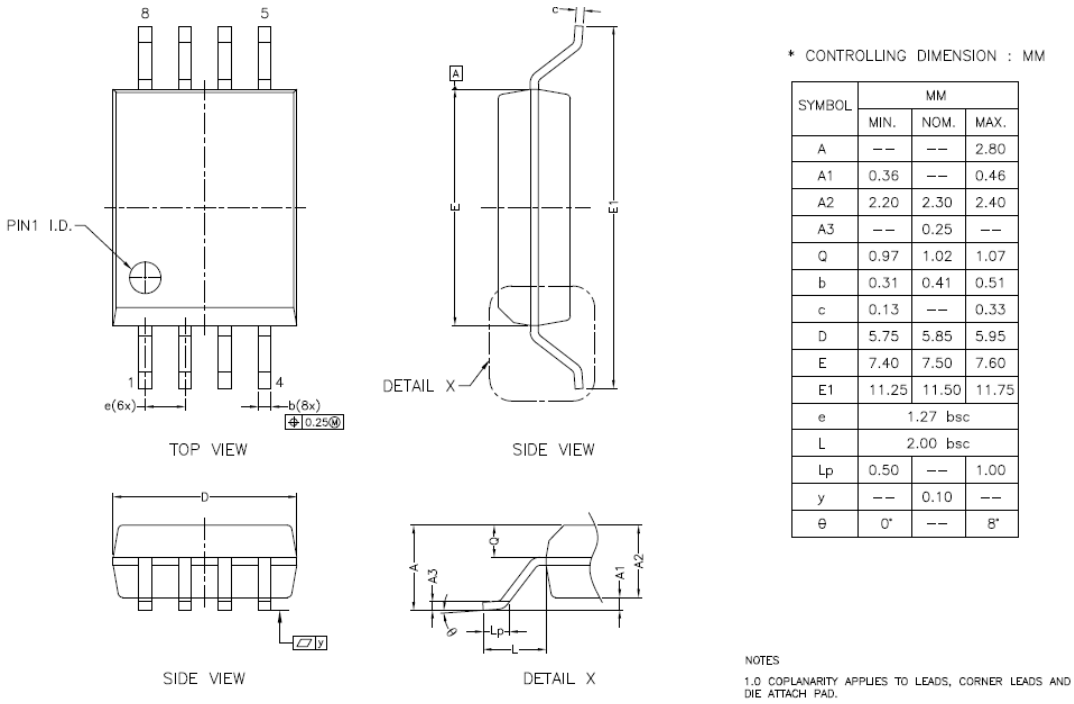


LAND PATTERN EXAMPLE(mm)



SOLDER MASK DETAILS

Figure 9.2 SOP8 Package Board Layout Example



SYMBOL	MM		
	MIN.	NOM.	MAX.
A	--	--	2.80
A1	0.36	--	0.46
A2	2.20	2.30	2.40
A3	--	0.25	--
Q	0.97	1.02	1.07
b	0.31	0.41	0.51
c	0.13	--	0.33
D	5.75	5.85	5.95
E	7.40	7.50	7.60
E1	11.25	11.50	11.75
e	1.27 bsc		
L	2.00 bsc		
Lp	0.50	--	1.00
y	--	0.10	--
θ	0°	--	8°

NOTE: This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.

Figure 9.3 SOW8 Package Shape and Dimension in millimeters

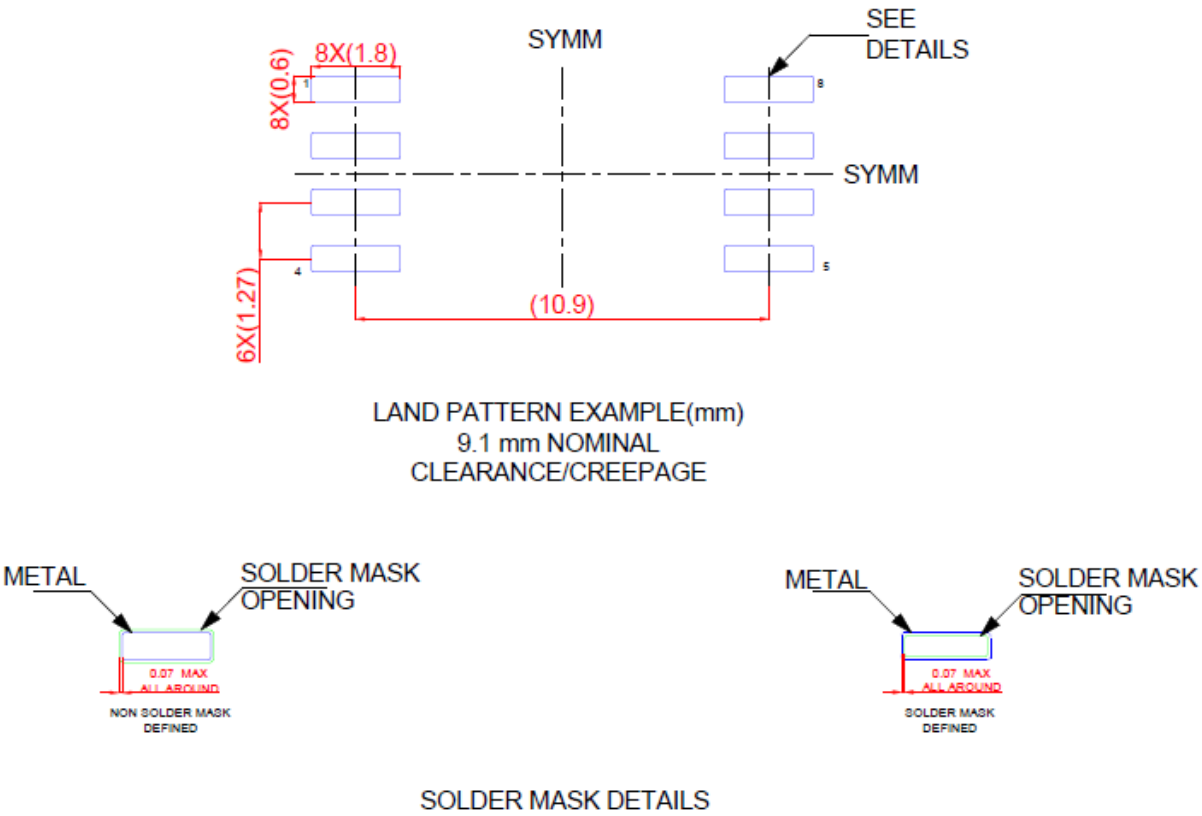
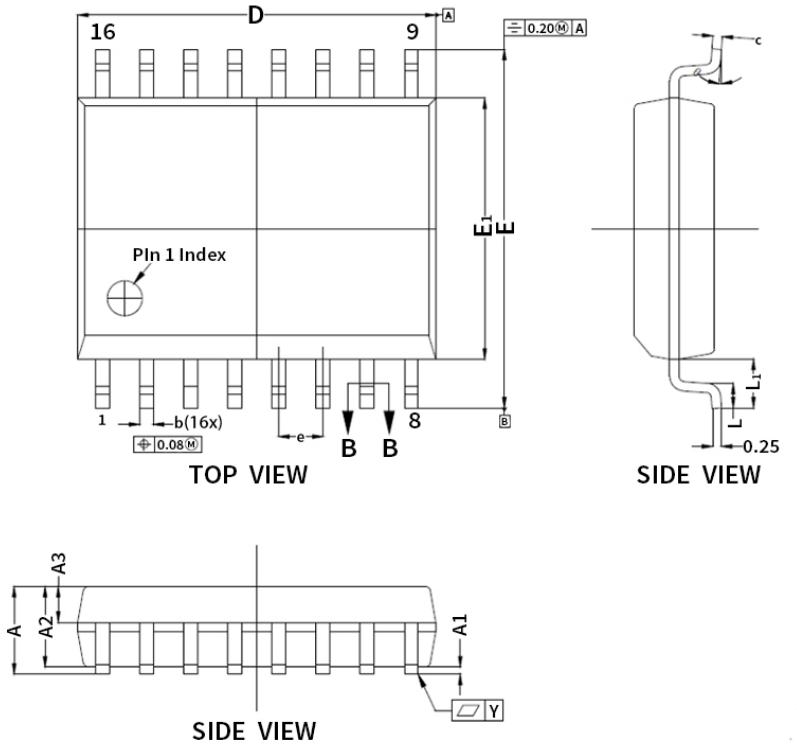


Figure 9.4 SOW8 Package Board Layout Example



* 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	---	0.43
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°

NOTE: This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.

Figure 9.5 SOP16(300mil)/SOW16 Package Shape and Dimension in millimeters

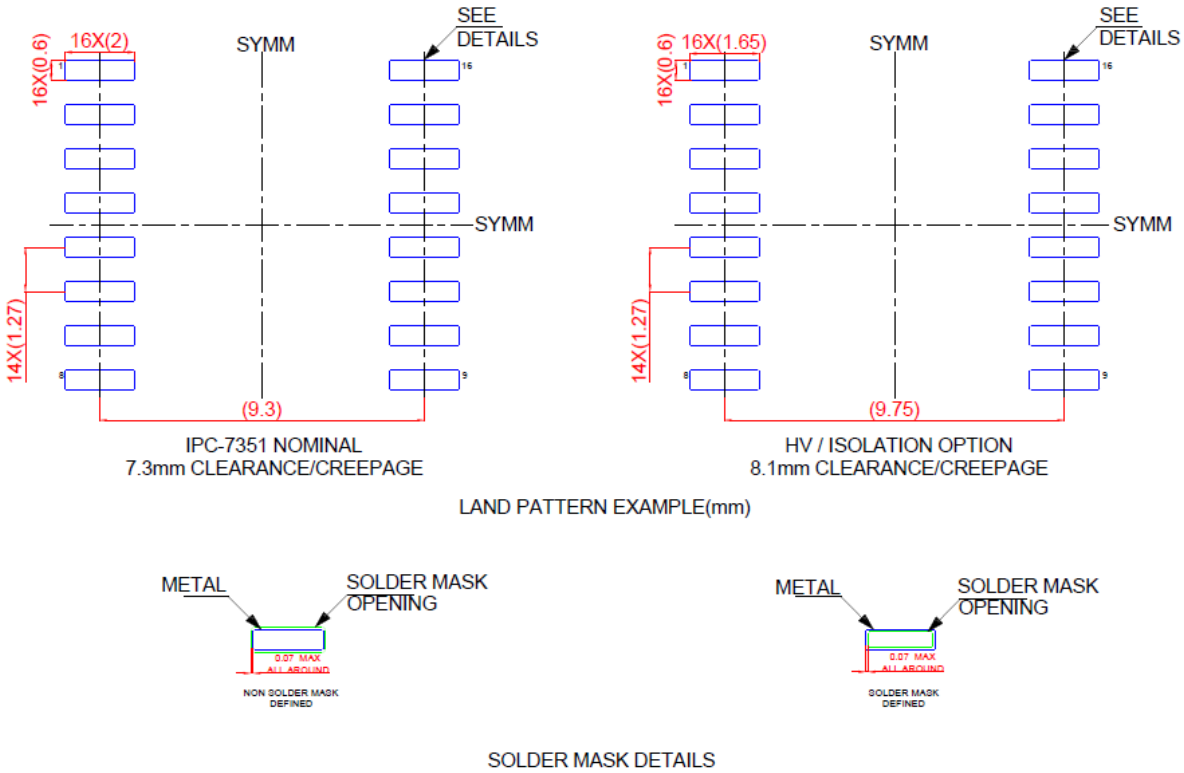


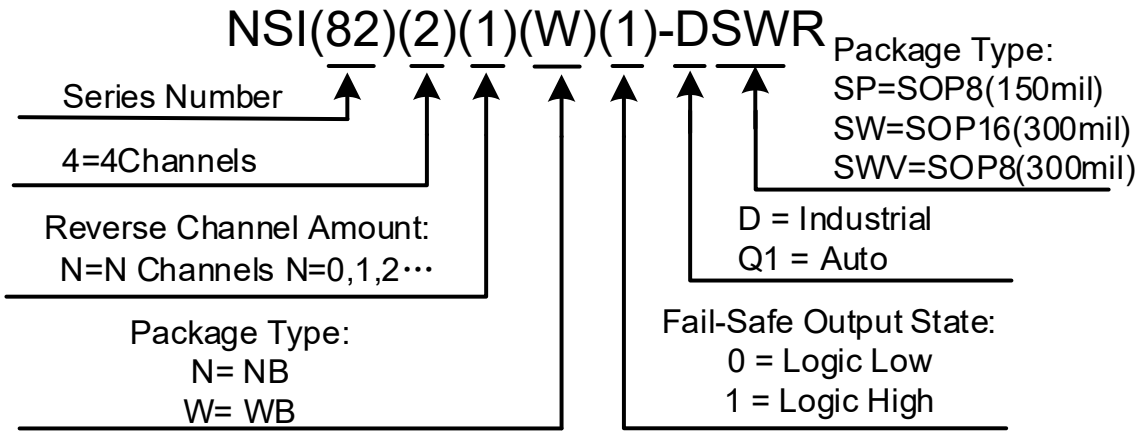
Figure 9.6 SOP16(300mil)/SOW16 Package Board Layout Example

10. Ordering Information

Part Number	Isolation Rating (kV)	Number of side 1 inputs	Number of side 2 inputs	Max Data Rate (Mbps)	Default Output State	Temperature	MSL	Package Type	Package Drawing	SPQ
NSI8210N0-DSPR	3.75	1	0	150	Low	-40 to 125℃	1	SOP8 (150mil)	SOP8	2500
NSI8210N1-DSPR	3.75	1	0	150	High	-40 to 125℃	1	SOP8 (150mil)	SOP8	2500
NSI8210N0-Q1SPR	3.75	1	0	150	Low	-40 to 125℃	1	SOP8 (150mil)	SOP8	2500
NSI8210N1-Q1SPR	3.75	1	0	150	High	-40 to 125℃	1	SOP8 (150mil)	SOP8	2500
NSI8210W0-DSWVR	5	1	0	150	Low	-40 to 125℃	3	SOP8 (300mil)	SOW8	1000
NSI8210W1-DSWVR	5	1	0	150	High	-40 to 125℃	3	SOP8 (300mil)	SOW8	1000
NSI8210W0-Q1SWVR	5	1	0	150	Low	-40 to 125℃	3	SOP8 (300mil)	SOW8	1000
NSI8210W1-Q1SWVR	5	1	0	150	High	-40 to 125℃	3	SOP8 (300mil)	SOW8	1000
NSI8210W0-DSWR	5	1	0	150	Low	-40 to 125℃	2	SOW16 (300mil)	SOW16	1000
NSI8210W1-DSWR	5	1	0	150	High	-40 to 125℃	2	SOW16 (300mil)	SOW16	1000
NSI8210W0-Q1SWR	5	1	0	150	Low	-40 to 125℃	2	SOW16 (300mil)	SOW16	1000
NSI8210W1-Q1SWR	5	1	0	150	High	-40 to 125℃	2	SOW16 (300mil)	SOW16	1000

NOTE: All packages are RoHS-compliant with peak reflow temperatures of 260 °C according to the JEDEC industry standard classifications and peak solder temperatures.
Automotive devices are AEC-Q100 qualified.

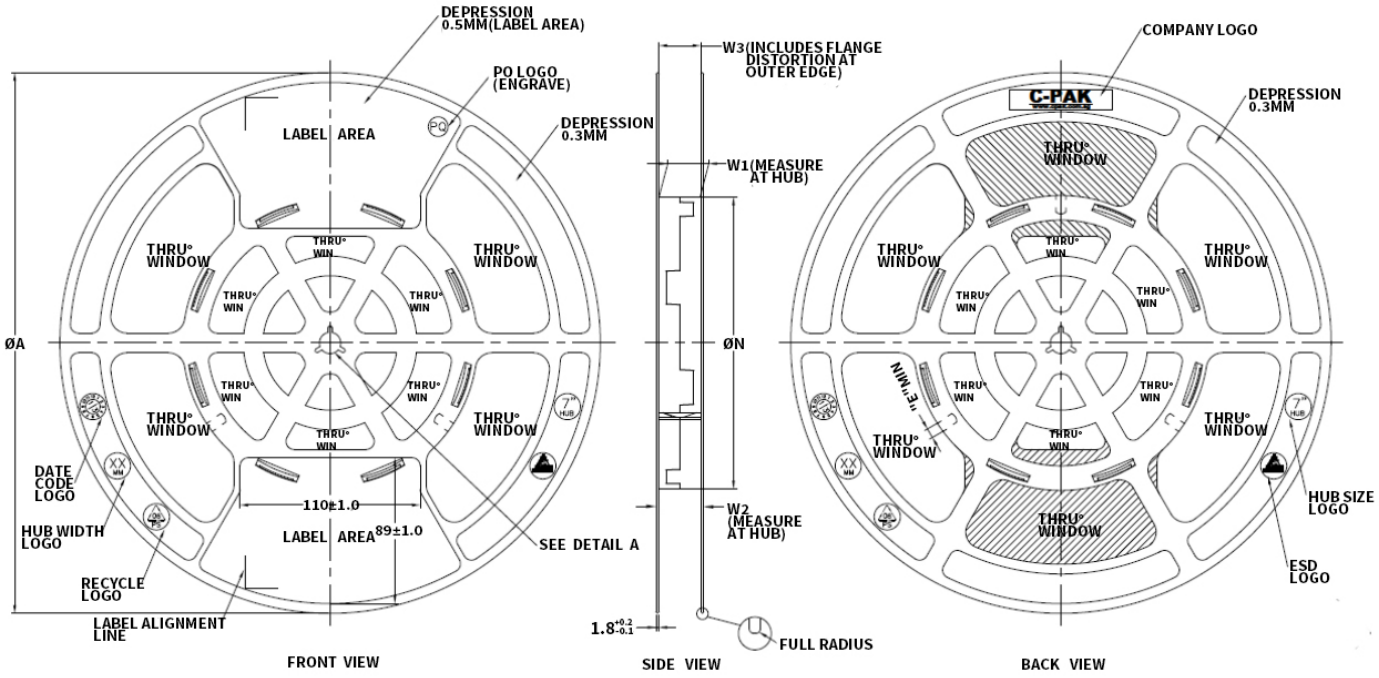
Part Number Rule:

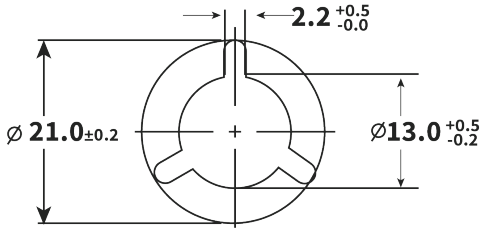


11. Documentation Support

Part Number	*Product Folder*	*Datasheet*	*Technical Documents*	*Isolator selection guide*
NSI8210	tbd	tbd	tbd	tbd

12. Tape and Reel Information



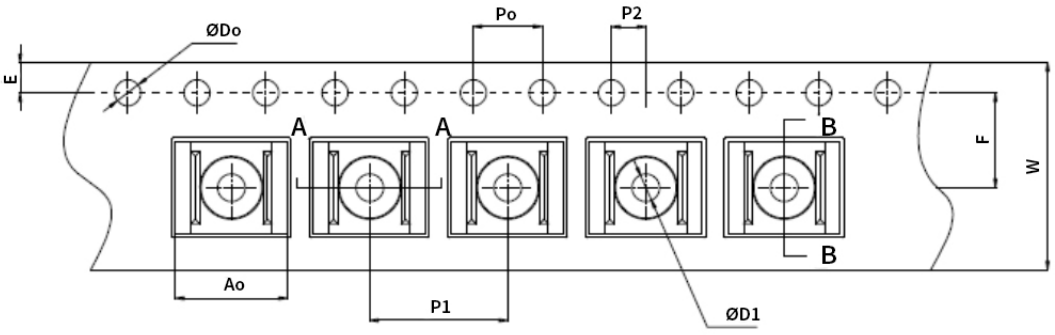


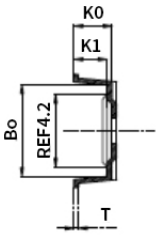
ARBOR HOLE
DETAIL A
SCALE: 3:1

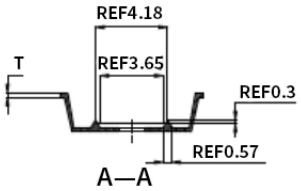
PRODUCT SPECIFICATION						
TAPE WIDTH	ØA ±2.0	ØN ±2.0	W1	W2 (Max)	W3	E (MIN)
08MM	330	178	8.4 +1.5 -0.0	14.4	SHALL ACCOMMODATE TAPE WIDTH WITHOUT NTERFERENCE	5.5
12MM	330	178	12.4 +2.0 -0.0	18.4		5.5
16MM	330	178	16.4 +2.0 -0.0	22.4		5.5
24MM	330	178	24.4 +2.0 -0.0	30.4		5.5
32MM	330	178	32.4 +2.0 -0.0	38.4		5.5

SURFACE RESISTIVITY			
LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW 10^{12}	ANTISTATIC	ALL TYPES
B	10^{6} TO 10^{11}	STATIC DISSIPATIVE	BLACK ONLY
C	10^{5} & BELOW 10^{5}	CONDUCTIVE(GENERIC)	BLACK ONLY
E	10^{9} TO 10^{11}	ANTISTATIC(COATED)	ALL TYPES

Figure 12.1 Reel Information (for all packages)





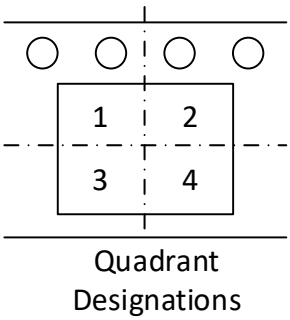


Common size

Appearance	Size(mm)
E	1.75±0.10
F	5.5±0.10
P2	2.00±0.10
D0	1.55±0.05
D1	1.6±0.10
P0	4.00±0.10
10P0	40.00±0.20

Pocket size

Appearance	Size(mm)
W	12.00±0.30
P_1	8.00±0.10
A_o	6.50±0.10
B_o	5.30±0.10
K_o	2.20±0.10
K_1	1.90±0.10
T	0.30±0.05



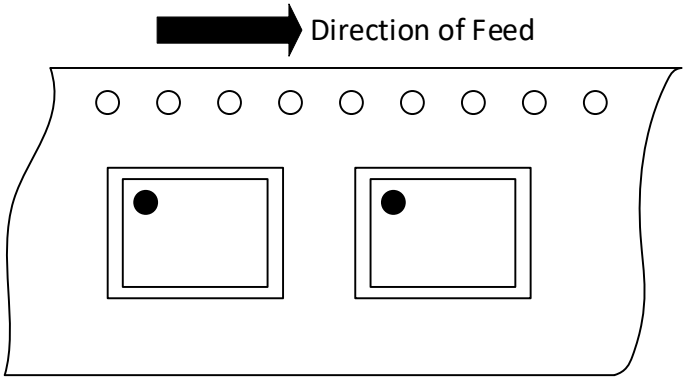
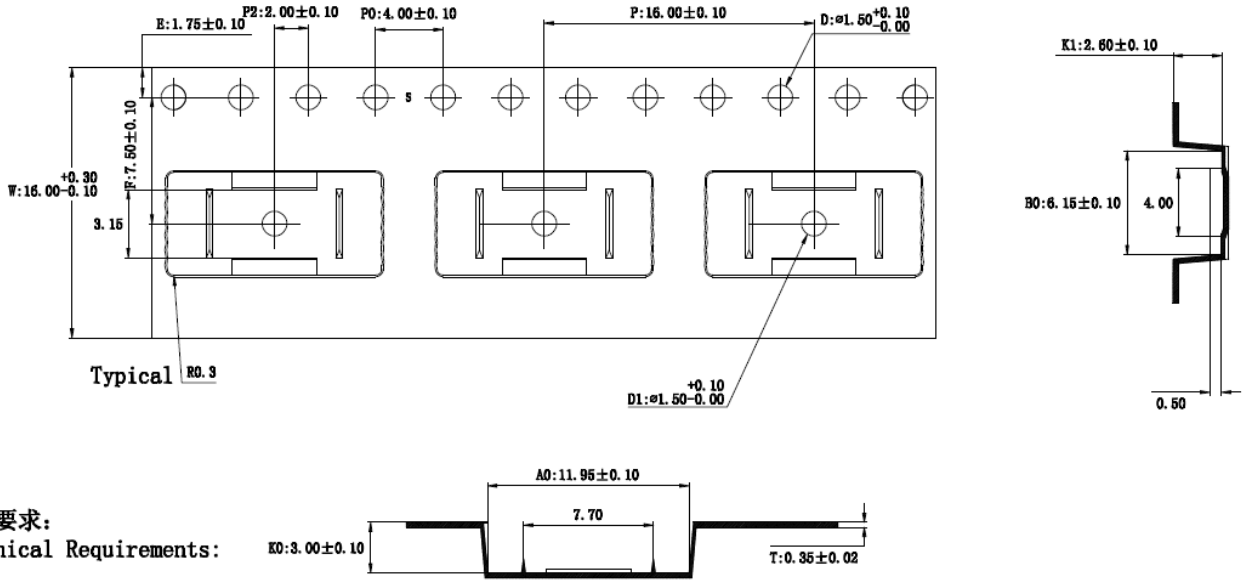


Figure 12.2 Tape Information of SOP8



技术要求：
Technical Requirements:

1. 每10个料带链孔径累计公差为±0.20毫米。
   10 sprocket hole pitch cumulative toleran±0.20mm
2. 料带弯曲每250毫米不可超过1毫米。
   Carrier camber is within 1 mm in 250 mm
3. 所有尺寸符合EIA-481-D标准要求。
   All dimensions meet EIA-481-D requirements

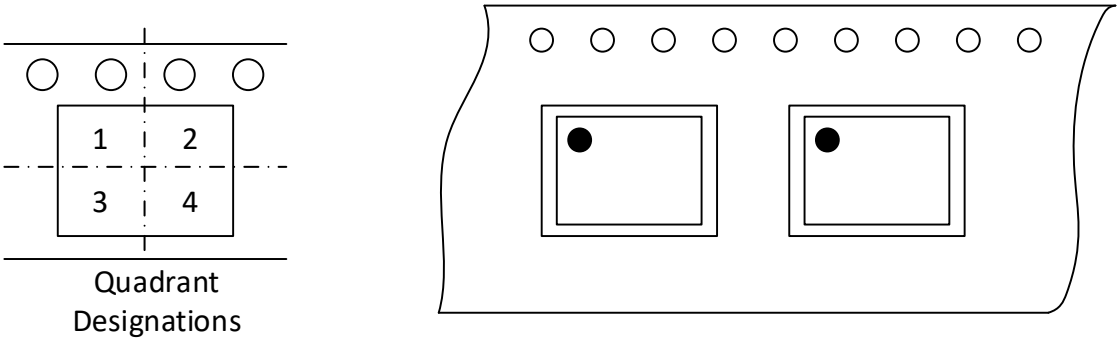
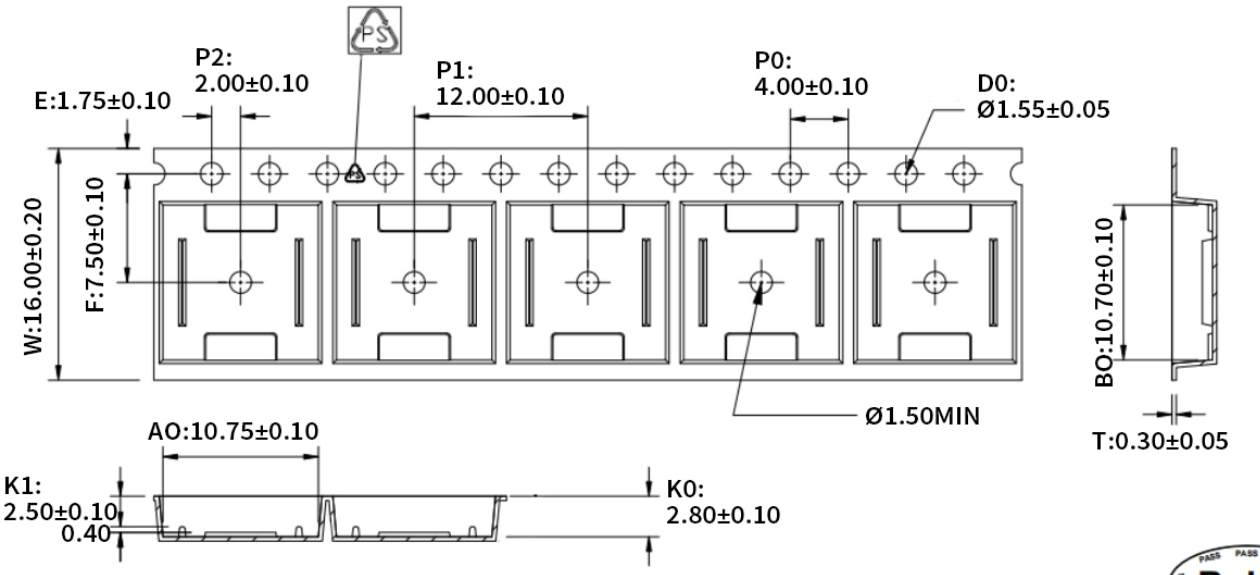


Figure 12.3 Tape Information of SOW8



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.(Rewind N=122)
7. Component load per 13" reel: 1000 pcs.
8. Surface resistivity:10^5~ 10^{10}Ω/口

RoHS

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

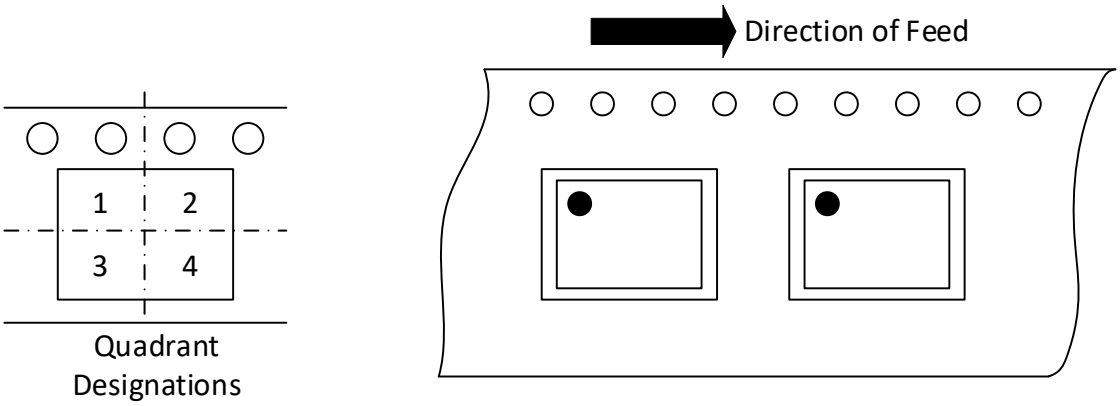


Figure 12.4 Tape Information of SOW16

13. Revision History

Revision	Description	Date
1.0	Initial Version.	2020/12/7
1.1	Update Pin Configuration and Functions	2022/3/1
1.2	Update Insulation and Safety Related Specifications, add Thermal Derating Curve, add Junction Temperature, Change Tstg to -65, Update SOW16 Package information	2022/9/14
1.3	Correct formatting and images. Update Input characteristics. Update Safety certification info throughout the document. Update eye diagram. Update Package Information and Tape and Reel Information. Update Function Description. Update Applications description. change the CTI of SOP8 from 400 to 600, change the Material Group of SOP8 from II to I.	2025/3/15

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as any warranty or authorization of, express or implied, including but not limited to accuracy, completeness, merchantability, fitness for a particular purpose or infringement of any third party's intellectual property rights.

You are solely responsible for your use of Novosense' products and applications, and for the safety thereof. You shall comply with all laws, regulations and requirements related to Novosense's products and applications, although information or support related to any application may still be provided by Novosense.

The resources are intended only for skilled developers designing with Novosense' products. Novosense reserves the rights to make corrections, modifications, enhancements, improvements or other changes to the products and services provided. Novosense authorizes you to use these resources exclusively for the development of relevant applications designed to integrate Novosense's products. Using these resources for any other purpose, or any unauthorized reproduction or display of these resources is strictly prohibited. Novosense shall not be liable for any claims, damages, costs, losses or liabilities arising out of the use of these resources.

For further information on applications, products and technologies, please contact Novosense (www.novosns.com).

Suzhou Novosense Microelectronics Co., Ltd