NSi8140S/NSi8141S/NSi8142S

Small Package Quad-Channel Digital Isolators

Datasheet (EN) 1.6

Product Overview

The NSi814xS devices are small package quad-channel digital isolators. The NSi814xS device is safety certified by UL1577 support 3kVrms insulation withstand voltages, while providing high electromagnetic immunity and low emissions at low power consumption. The data rate of the NSi814xS is up to 150Mbps, and the common-mode transient immunity (CMTI) is up to 150kV/us. The NSi814xS device provides digital channel direction configuration and the default output level configuration when the input power is lost. Wide supply voltage of the NSi814xS device support to connect with most digital interface directly, easy to do the level shift. High system level EMC performance enhance reliability and stability of use.

Key Features

- Up to 3000Vrms Insulation voltage
- Date rate: DC to 150Mbps
- Power supply voltage: 2.5V to 5.5V
- High CMTI: 150kV/us
- Chip level ESD: HBM: ±6kV
- High system level EMC performance:
- Enhanced system level ESD, EFT, Surge immunity
- Default output high level or low level option
- Low power consumption: 1.5mA/ch (1 Mbps)
- Low propagation delay: <15ns
- Operation temperature: -40℃~125℃
- RoHS-compliant packages: SSOP16(150mil)

Safety Regulatory Approvals

- UL recognition: up to 3000Vrms for 1 minute per UL1577
- CQC certification per GB4943.1-2011
- CSA component notice 5A approval
- IEC60950-1 standard
- DIN VDE V 0884-10 (VDE V 0884-10): 2006-12

Applications

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

Device Information

Part Number	*Package*	*Body Size*
NSI814xSx	SSOP16	4.90mm × 3.90mm

Functional Block Diagrams

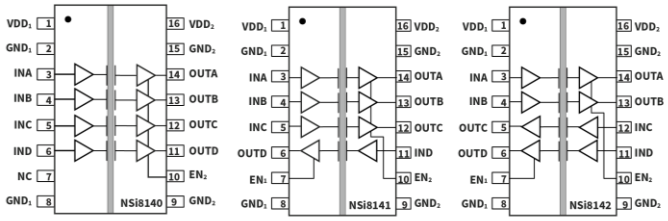


Figure 1. NSi814xS Block Diagram

INDEX

1. Pin Configuration and Functions

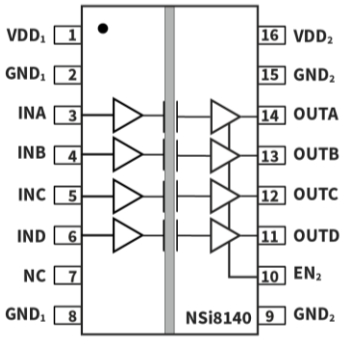


Figure 1.1 NSi8140S Package

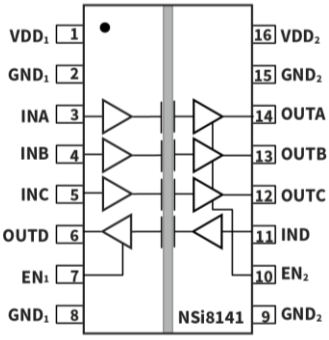


Figure 1.2 NSi8141S Package

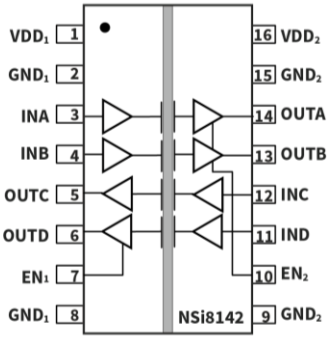


Figure 1.3 NSi8142S Package

Table1.1 NSi8140S/ NSi8141S/ NSi8142S Pin Configuration and Description

NSi8140S PIN NO.	*NSi8141S PIN NO.*	*NSi8142S PIN NO.*	*SYMBOL*	*FUNCTION*
1	1	1	VDD_1	Power Supply for Isolator Side 1
2	2	2	GND_1	Ground 1, the ground reference for Isolator Side 1
3	3	3	INA	Logic Input A
4	4	4	INB	Logic Input B
5	5	12	INC	Logic Input C
6	11	11	IND	Logic Input D
7	7	7	NC/ EN_1	No Connection. or Output Enable 1. Active high logic input. When EN_1 is high or NC, the output of Side 1 are enabled. When EN_1 is low, the output of Side 1 are disabled to high impedance state.
8	8	8	GND_1	Ground 1, the ground reference for Isolator Side 1
9	9	9	GND_2	Ground 2, the ground reference for Isolator Side 2
10	10	10	EN_2	Output Enable 2. Active high logic input. When EN_2 is high or NC, the output of Side 2 are enabled. When EN_2 is low, the output of Side 2 are disabled to high impedance state.
11	6	6	OUTD	Logic Output D
12	12	5	OUTC	Logic Output C
13	13	13	OUTB	Logic Output B
14	14	14	OUTA	Logic Output A
15	15	15	GND2	Ground 2, the ground reference for Isolator Side 2
16	16	16	VDD2	Power Supply 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	VINA,VINB, VINC, VIND	-0.4		VDD+0.4	V	
Maximum Output Voltage	VOUTA,VOUTB, VOUTC， VOUTD	-0.4		VDD+0.4	V	
Maximum Input/Output Pulse Voltage	VINA, VINB, VINC,VIND,VOUTA, VOUTB,VOUTC,VOUTD	-0.8		VDD+0.8	V	Pulse width should be less than 100ns, and the duty cycle should be less than 10%
Output current	Io	-15		15	mA	
Maximum Surge Isolation Voltage	V_{IOSM}			5.3	kV	
Operating Temperature	Topr	-40		125	℃	
Storage Temperature	Tstg	-65		150	℃	
Junction temperature	Tj			150	℃	
Electrostatic discharge	HBM			±6000	V	
	CDM			±2000	V	

3. Recommended Operating Conditions

Parameters	*Symbol*	*min*	*typ*	*max*	*unit*
Power Supply Voltage	VDD1, VDD2	2.5		5.5	V
Operating Temperature	Topr	-40		125	℃
High Level Input Voltage	VIH	2			V
Low Level Input Voltage	VIL			0.8	V
Data rate	DR			150	Mbps

4. Thermal Characteristics

Parameters	*Symbol*	*SSOP-16*	*Unit*
IC Junction-to-Air Thermal Resistance	θ_{JA}	100	℃/W
Junction-to-case(top) thermal resistance	θ_{JB}	54.4	℃/W
Junction-to-board thermal resistance	θ_{JC}	51.9	℃/W

5. Specifications

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Power on Reset	VDD_{POR}		2.2		V	POR threshold as during power-up
	VDD_{HYS}		0.1		V	POR threshold Hysteresis
Input Threshold	V_{IT}		1.6		V	Input Threshold at rising edge
	V_{IT_HYS}		0.4		V	Input Threshold Hysteresis
High Level Input Voltage	V_{IH}	2			V	
Low Level Input Voltage	V_{IL}			0.8	V	
High Level Output Voltage	V_{OH}	VDD-0.3			V	I_{OH} =- 4mA
Low Level Output Voltage	V_{OL}			0.3	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	trbs		40		usec	

5.1. Electrical Characteristics

(VDD1=2.5V~5.5V, VDD2=2.5V~5.5V, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at VDD1 = 5V, VDD2 = 5V, Ta = 25℃)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Power on Reset	VDD_{POR}		2.2		V	POR threshold as during power-up
	VDD_{HYS}		0.1		V	POR threshold Hysteresis
Input Threshold	V_{IT}		1.6		V	Input Threshold at rising edge
	V_{IT_HYS}		0.4		V	Input Threshold Hysteresis
High Level Input Voltage	V_{IH}	2			V	
Low Level Input Voltage	V_{IL}			0.8	V	
High Level Output Voltage	V_{OH}	VDD-0.3			V	I_{OH} =- 4mA
Low Level Output Voltage	V_{OL}			0.3	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	trbs		40		usec	
Common Mode Transient Immunity	CMTI	±100	±150		kV/us	

(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*
Supply current	**NSi8140S**					
	I_{DD1}(Q0)		0.894	1.34	mA	All Input 0V for NSi8140S0 Or All Input at supply for NSi8140S1
	I_{DD2}(Q0)		2.326	3.5	mA	
	I_{DD1}(Q1)		5.316	7.8	mA	All Input at supply for NSi8140S0 Or All Input 0V for NSi8140S1
	I_{DD2}(Q1)		2.432	3.65	mA	
	I_{DD1}(1M)		3.087	4.63	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.728	4.09	mA	
	I_{DD1}(10M)		3.182	4.77	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		5.834	8.75	mA	
	I_{DD1}(100M)		3.918	5.88	mA	All Input with 100Mbps,

Parameters	Symbol	Min	Typ	Max	Unit	Comments
	I_{DD2}(100M)		37.06	55.6	mA	C_L=15pF
	NSi8141S					
	I_{DD1}(Q0)		1.244	1.87	mA	All Input 0V for NSi8141S0 Or All Input at supply for NSi8141S1
	I_{DD2}(Q0)		2.164	3.25	mA	
	I_{DD1}(Q1)		4.658	7	mA	All Input at supply for NSi8141S0 Or All Input 0V for NSi8141S1
	I_{DD2}(Q1)		3.416	5	mA	
	I_{DD1}(1M)		3.07	4.6	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		3.064	4. 6	mA	
	I_{DD1}(10M)		3.82	5.7	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		5.496	8.2	mA	
	I_{DD1}(100M)		10.708	16.06	mA	All Input with 100Mbps, C_L= 15pF
	I_{DD2}(100M)		29.336	44	mA	
	NSi8142S					
	I_{DD1}(Q0)		1.688	2.5	mA	All Input 0V for NSi8142S0 Or All Input at supply for NSi8142S1
	I_{DD2}(Q0)		1.704	2.56	mA	
	I_{DD1}(Q1)		4.038	6.06	mA	All Input at supply for NSi8142S0 Or All Input 0V for NSi8142S1
	I_{DD2}(Q1)		4.1	6.15	mA	
	I_{DD1}(1M)		3.06	4.6	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		3.108	4.7	mA	
	I_{DD1}(10M)		4.578	6.9	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		4.694	7	mA	
	I_{DD1}(100M)		19	28.5	mA	All Input with 100Mbps, C_L= 15pF
	I_{DD2}(100M)		20.868	31	mA	
Data Rate	DR	0		150	Mbps	
Minimum Pulse Width	PW			5.0	ns	
Propagation Delay	t_{PLH}	5	8.20	15	ns	See Figure 5.9 , C_L = 15pF
	t_{PHL}	5	10.56	15	ns	See Figure 5.9 , C_L = 15pF
Pulse Width Distortion $\lvert t_{PHL} - t_{PLH} \rvert$	PWD			5.0	ns	See Figure 5.9 , C_L = 15pF
Rising Time	t_r			5.0	ns	See Figure 5.9 , C_L = 15pF

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Falling Time	t_f			5.0	ns	See Figure 5.9 , C_L = 15pF
Peak Eye Diagram Jitter	t_{JIT}(PK)		350		ps	
Channel-to-Channel Delay Skew	t_{SK}(c2c)			2.5	ns	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	
Disable high to Tri-State	t_{PHZ}		14.88		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Enable to Data high Valid	t_{PZH}		10.00		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Disable low to Tri-State	t_{PLZ}		17.25		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Enable to Data high Valid	t_{PZL}		10.85		ns	See Figure 5.10 , C_L = 15pF, R_L=1k

(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
Supply current	**NSi8140S**					
	I_{DD1}(Q0)		0.832	1.25	mA	All Input 0V for NSi8140S0 Or All Input at supply for NSi8140S1
	I_{DD2}(Q0)		2.214	3.3	mA	
	I_{DD1}(Q1)		5.23	7.9	mA	All Input at supply for NSi8140S0 Or All Input 0V for NSi8140S1
	I_{DD2}(Q1)		2.32	3.48	mA	
	I_{DD1}(1M)		3.01	4.5	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.486	3.73	mA	
	I_{DD1}(10M)		3.106	4.66	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		4.476	6.7	mA	
	I_{DD1}(100M)		3.826	5.74	mA	All Input with 100Mbps, C_L=15pF
	I_{DD2}(100M)		25.5	38	mA	
	NSi8141S					
	I_{DD1}(Q0)		1.165	1.75	mA	All Input 0V for NSi8141S0 Or All Input at supply for NSi8141S1
	I_{DD2}(Q0)		2.062	3.1	mA	
	I_{DD1}(Q1)		4.566	6.85	mA	All Input at supply for NSi8141S0 Or All Input 0V for NSi8141S1
	I_{DD2}(Q1)		3.306	5	mA	
	I_{DD1}(1M)		2.954	4.4	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.862	4.3	mA	

Parameters	Symbol	Min	Typ	Max	Unit	Comments
	I_{DD1}(10M)		3.452	5.2	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		4.368	6.5	mA	
	I_{DD1}(100M)		8.084	12	mA	All Input with 100Mbps, C_L= 15pF
	I_{DD2}(100M)		19.96	30	mA	
	NSi8142S					
	I_{DD1}(Q0)		1.598	2.4	mA	All Input 0V for NSi8142S0 Or All Input at supply for NSi8142S1
	I_{DD2}(Q0)		1.618	2.43	mA	
	I_{DD1}(Q1)		3.942	5.9	mA	All Input at supply for NSi8142S0 Or All Input 0V for NSi8142S1
	I_{DD2}(Q1)		4.004	6	mA	
	I_{DD1}(1M)		2.901	4.3	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.9452	4.4	mA	
	I_{DD1}(10M)		3.898	5.85	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		3.976	6	mA	
	I_{DD1}(100M)		12.9	19	mA	All Input with 100Mbps, C_L= 15pF
	I_{DD2}(100M)		14.868	22	mA	
Data Rate	DR	0		150	Mbps	
Minimum Pulse Width	PW			5.0	ns	
Propagation Delay	t_{PLH}	5	9.20	15	ns	See Figure 5.9 , C_L = 15pF
	t_{PHL}	5	10.40	15	ns	See Figure 5.9 , C_L = 15pF
Pulse Width Distortion $\lvert t_{PHL} - t_{PLH} \rvert$	PWD			5.0	ns	See Figure 5.9 , C_L = 15pF
Rising Time	t_r			5.0	ns	See Figure 5.9 , C_L = 15pF
Falling Time	t_f			5.0	ns	See Figure 5.9 , C_L = 15pF
Peak Eye Diagram Jitter	t_{JIT}(PK)		350		ps	
Channel-to-Channel Delay Skew	t_{SK}(c2c)			2.5	ns	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	
Disable high to Tri-State	t_{PHZ}		17.85		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Enable to Data high Valid	t_{PZH}		13.37		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Disable low to Tri-State	t_{PLZ}		20.6		ns	See Figure 5.10 , C_L = 15pF, R_L=1k

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Enable to Data high Valid	t_{PZL}		13.67		ns	See Figure 5.10 , C_L = 15pF, R_L=1k

(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
Supply current	**NSi8140S**					
	I_{DD1}(Q0)		0.802	1.2	mA	All Input 0V for NSi8140S0 Or All Input at supply for NSi8140S1
	I_{DD2}(Q0)		2.161	3.24	mA	
	I_{DD1}(Q1)		5.17	7.8	mA	All Input at supply for NSi8140S0 Or All Input 0V for NSi8140S1
	I_{DD2}(Q1)		2.282	3.4	mA	
	I_{DD1}(1M)		2.968	4.45	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.384	3.58	mA	
	I_{DD1}(10M)		3.056	4.58	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		3.862	5.8	mA	
	I_{DD1}(100M)		3.772	5.67	mA	All Input with 100Mbps, C_L=15pF
	I_{DD2}(100M)		19.54	29.3	mA	
	NSi8141S					
	I_{DD1}(Q0)		1.128	1.7	mA	All Input 0V for NSi8141S0 Or All Input at supply for NSi8141S1
	I_{DD2}(Q0)		2.012	3	mA	
	I_{DD1}(Q1)		4.51	6.8	mA	All Input at supply for NSi8141S0 Or All Input 0V for NSi8141S1
	I_{DD2}(Q1)		3.248	4.9	mA	
	I_{DD1}(1M)		2.894	4.3	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.766	4.15	mA	
	I_{DD1}(10M)		3.272	4.9	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		3.892	5.8	mA	
	I_{DD1}(100M)		6.95	10.4	mA	All Input with 100Mbps, C_L= 15pF
	I_{DD2}(100M)		15.706	23.56	mA	
	NSi8142S					
	I_{DD1}(Q0)		1.556	2.3	mA	All Input 0V for NSi8142S0 Or All Input at supply for NSi8142S1
	I_{DD2}(Q0)		1.574	2.4	mA	

	I_{DD1}(Q1)		3.884	5.8	mA	All Input at supply for NSi8142S0 Or All Input 0V for NSi8142S1
	I_{DD2}(Q1)		3.942	5.9	mA	
	I_{DD1}(1M)		2.824	4.3	mA	All Input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.866	4.3	mA	
	I_{DD1}(10M)		3.574	5.36	mA	All Input with 10Mbps, C_L=15pF
	I_{DD2}(10M)		3.642	5.46	mA	
	I_{DD1}(100M)		10.678	16	mA	All Input with 100Mbps, C_L = 15pF
	I_{DD2}(100M)		11.618	17	mA	
Data Rate	DR	0		150	Mbps	
Minimum Pulse Width	PW			5.0	ns	
Propagation Delay	t_{PLH}	5	10.0	15	ns	See Figure 5.9 , C_L = 15pF
	t_{PHL}	5	10.0	15	ns	See Figure 5.9 , C_L = 15pF
Pulse Width Distortion $\lvert t_{PHL} - t_{PLH} \rvert$	PWD			5.0	ns	See Figure 5.9 , C_L = 15pF
Rising Time	t_r			5.0	ns	See Figure 5.9 , C_L = 15pF
Falling Time	t_f			5.0	ns	See Figure 5.9 , C_L = 15pF
Peak Eye Diagram Jitter	t_{JIT}(PK)		350		ps	
Channel-to-Channel Delay Skew	t_{SK}(c2c)			2.5	ns	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	
Disable high to Tri-State	t_{PHZ}		20.6		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Enable to Data high Valid	t_{PZH}		18.12		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Disable low to Tri-State	t_{PLZ}		21.85		ns	See Figure 5.10 , C_L = 15pF, R_L=1k
Enable to Data high Valid	t_{PZL}		20.02		ns	See Figure 5.10 , C_L = 15pF, R_L=1k

5.2. Typical Performance Characteristics

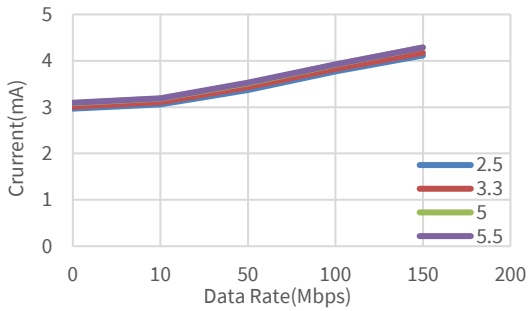


Figure 5.1 NSi8140S VDD1 Supply Current vs Data Rate

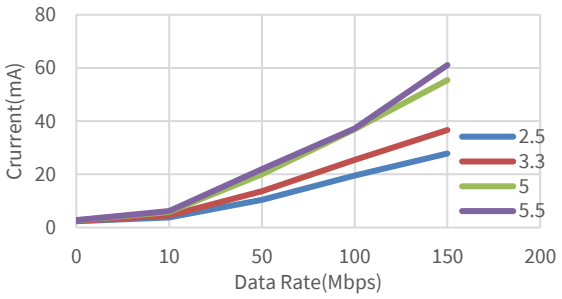


Figure 5.2 NSi8140S VDD2 Supply Current vs Data Rate

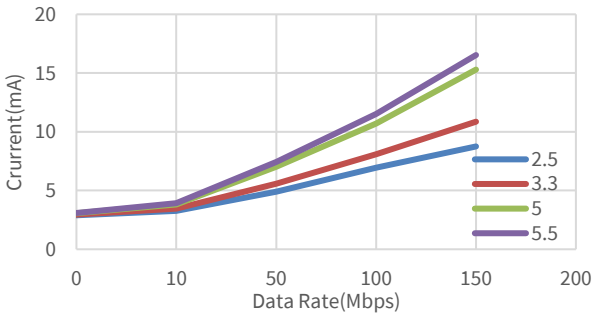


Figure 5.3 NSi8141S VDD1 Supply Current vs Data Rate

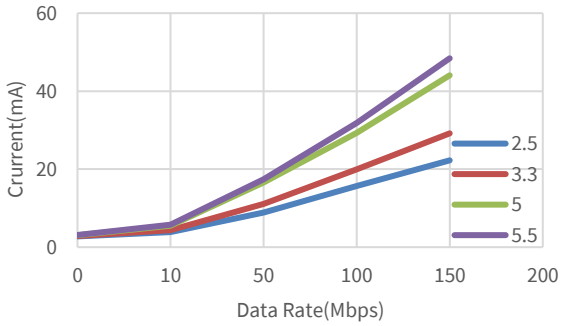


Figure 5.4 NSi8141S VDD2 Supply Current vs Data Rate

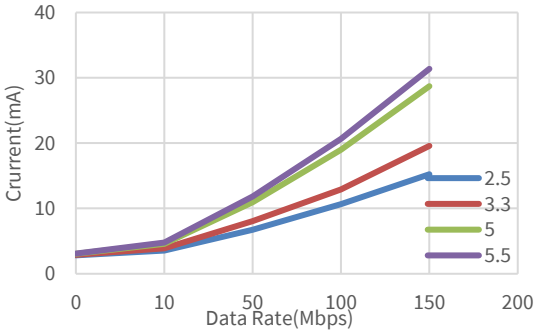


Figure 5.5 NSi8142S VDD1 Supply Current vs Data Rate

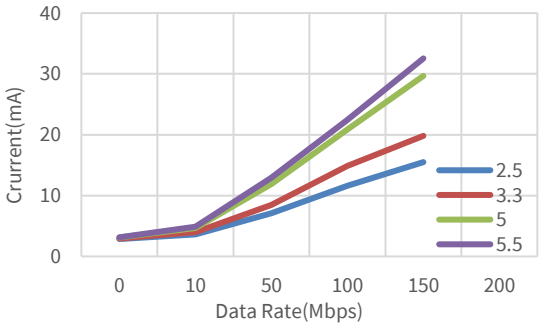


Figure 5.6 NSi8142S VDD2 Supply Current vs Data Rate

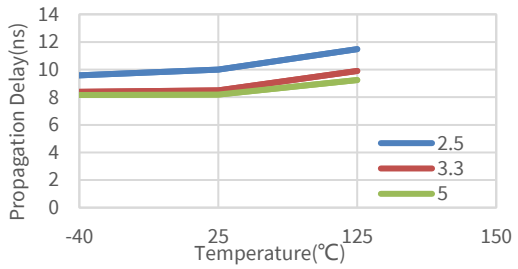


Figure 5.7 Rising Edge Propagation Delay Vs Temp

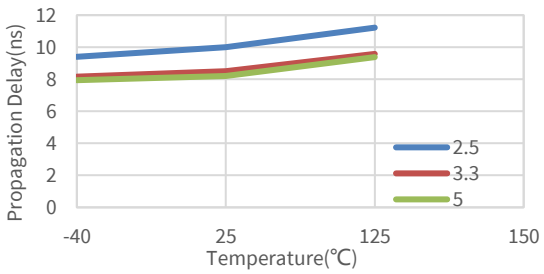


Figure 5.8 Falling Edge Propagation Delay Vs Temp

5.3. Parameter Measurement Information

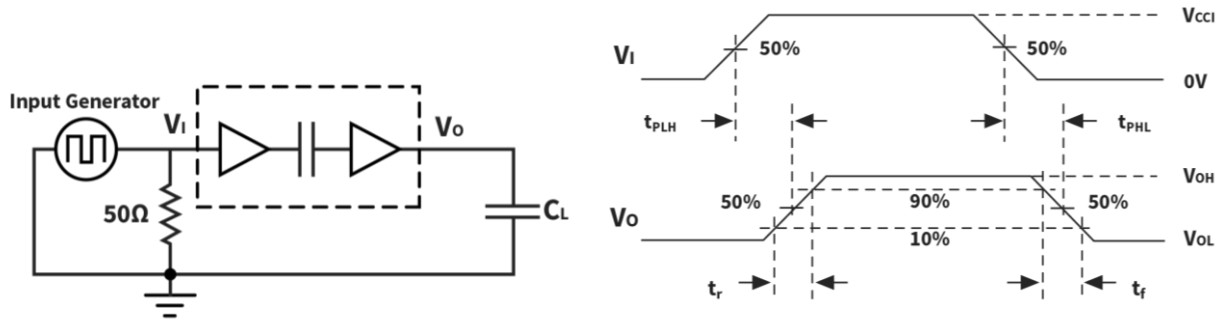


Figure 5.9 Switching Characteristics Test Circuit and Waveform

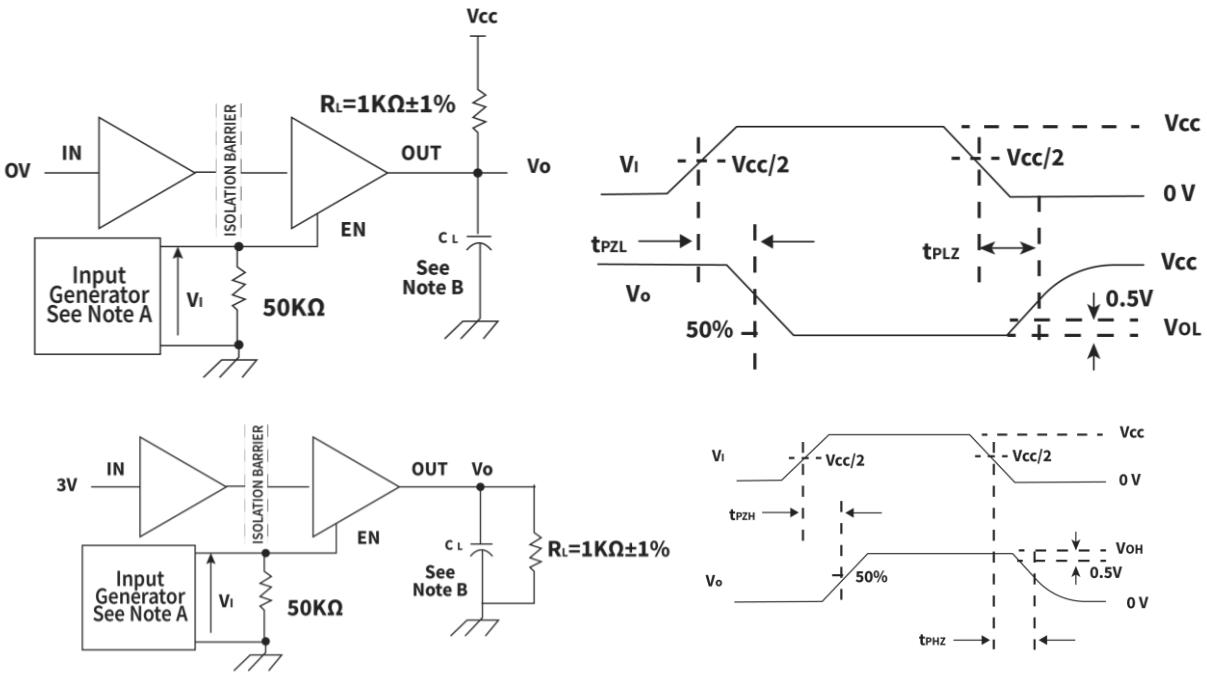


Figure 5.10 Enable/Disable Propagation Delay Time Test Circuit and Waveform

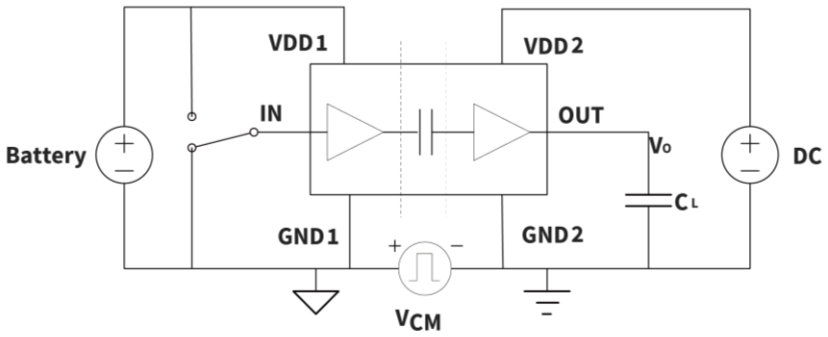


Figure 5.11 Common-Mode Transient Immunity Test Circuit

Note A :The input pulse is supplied by a generator having the following characteristics: PRR ≤ 50 kHz, 50% duty cycle, tr ≤ 3 ns, tf ≤ 3 ns, Z_O = 50 Ω. At the input, a 50-Ω resistor is required to terminate the Input Generator signal. It is not needed in actual application.

NoteB : C_L = 15 pF and includes instrumentation and fixture capacitance within ±20%.

6. High Voltage Feature Description

6.1. Insulation and Safety Related Specifications

Description	*Test Condition*	*Symbol*	*SSOP-16*	*Unit*
Minimum External Air Gap (Clearance)		L(I01)	3.9	mm
Minimum External Tracking (Creepage)		L(I02)	3.9	mm
Minimum internal gap		DTI	20	um
Tracking Resistance (Comparative Tracking Index)	DIN EN 60112 (VDE 0303-11)	CTI	>400	V
Material Group	IEC 60112		Ⅱ	
Installation Classification per DIN VDE 0110				
For Rated Mains Voltage ≤ 150V_{rms}			Ⅰ to Ⅳ	
For Rated Mains Voltage ≤ 300V_{rms}			Ⅰ to Ⅲ	
For Rated Mains Voltage ≤ 400V_{rms}			Ⅰ to Ⅲ	
Insulation Specification per DIN VDE V 0884-11:2017-01[1)]				
Climatic Classification			10/105/21	
Pollution Degree per DIN VDE 0110, Table 1			2	
Maximum repetitive peak isolation voltage		V_{IORM}	565	Vpeak
Maximum working isolation voltage	AC voltage	V_{IOWM}	400	V_{RMS}
	DC voltage		565	Vpeak

Description	Test Condition	Symbol	SSOP-16	Unit
Input to Output Test Voltage, Method B1	$V_{IORM} \times 1.5 = V_{pd(m)}$, 100% production test, $t_{ini} = t_m = 1$ sec, partial discharge < 5 pC	$V_{pd(m)}$	847	Vpeak
Input to Output Test Voltage, Method A				
After Environmental Tests Subgroup 1	$V_{IORM} \times 1.2 = V_{pd(m)}$, $t_{ini} = 60$ sec, $t_m = 10$ sec, partial discharge < 5 pC	$V_{pd(m)}$	678	Vpeak
After Input and /or Safety Test Subgroup 2 and Subgroup 3	$V_{IORM} \times 1.2 = V_{pd(m)}$, $t_{ini} = 60$ sec, $t_m = 10$ sec, partial discharge < 5 pC	$V_{pd(m)}$	678	Vpeak
Maximum transient isolation voltage	t = 60 sec	VIOTM	5300	Vpeak
Maximum Surge Isolation Voltage	Test method per IEC60065,1.2/50us waveform, VTEST=VIOSM×1.3	VIOSM	5384	Vpeak
Isolation resistance	VIO =500V	RIO	$>10^9$	Ω
Isolation capacitance	f = 1MHz	CIO	0.6	pF
Insulation Specification per UL1577				
Withstand Isolation Voltage	$V_{TEST} = 1.2 \times V_{ISO}$, t = 1 sec, 100% production test	V_{ISO}	3000	V_{rms}

1) This coupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

6.2. Safety-Limiting Values

Basic isolation safety-limiting values as outlined in VDE-0884-11 of NSi814xSx (SSOP16)

Description	Test Condition	Value	Unit
Safety Supply Power	$R_{\theta JA}$ = 100°C /W[1)], T_J = 150 °C, T_A = 25 °C	1250	mW
Safety Supply Current	$R_{\theta JA}$ = 100°C/W[1)], V_I = 5V, T_J = 150 °C, T_A = 25 °C	250	mA
Safety Temperature[2)]		150	°C

1) Calculate with the junction-to-air thermal resistance, $R_{\theta JA}$, of SSOP16 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.

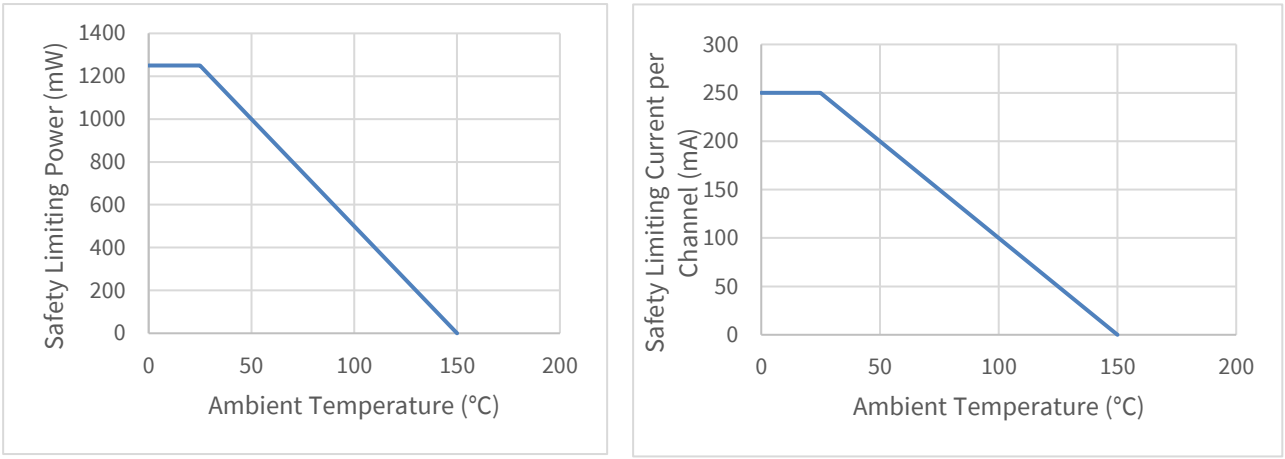


Figure 6.1 NSi8140S/NSi8141S /NSi8142S Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

6.3. Regulatory Information

The NSi8140S/NSi8141S /NSi8142S are approved or pending approval by the organizations listed in table.

CUL		*VDE*	*CQC*
UL 1577 Component Recognition Program[1]	Approved under CSA Component Acceptance Notice 5A	DIN VDE V 0884-11(VDE V 0884-11):2017-01[2]	Certified by CQC11-471543-2012 GB4943.1-2011
Single Protection, 3000V_{rms} Isolation voltage	Single Protection, 3000V_{rms} Isolation voltage	Basic Insulation 565Vpeak, V_{IOSM}=5384Vpeak	Basic insulation
File (E500602)	File (E500602)	File (40050121)	File (CQC19001233128)

7. Function Description

The NSi814xS is a Quad-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.

The NSi814xS device is safety certified by UL1577 support several insulation withstand voltages (3.75kV$_{rms}$, 5kV$_{rms}$), while providing high electromagnetic immunity and low emissions at low power consumption. The data rate of the NSi814xS is up to 150Mbps, and the common-mode transient immunity (CMTI) is up to 150kV/us. The NSi814xS device provides digital channel direction configuration and the default output level configuration when the input power is lost. Wide supply voltage of the NSi814xS device support to connect with most digital interface directly, easy to do the level shift. High system level EMC performance enhance reliability and stability of use.

The NSi814xS 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 output B follows the same status with the input A within 1us after powering up.

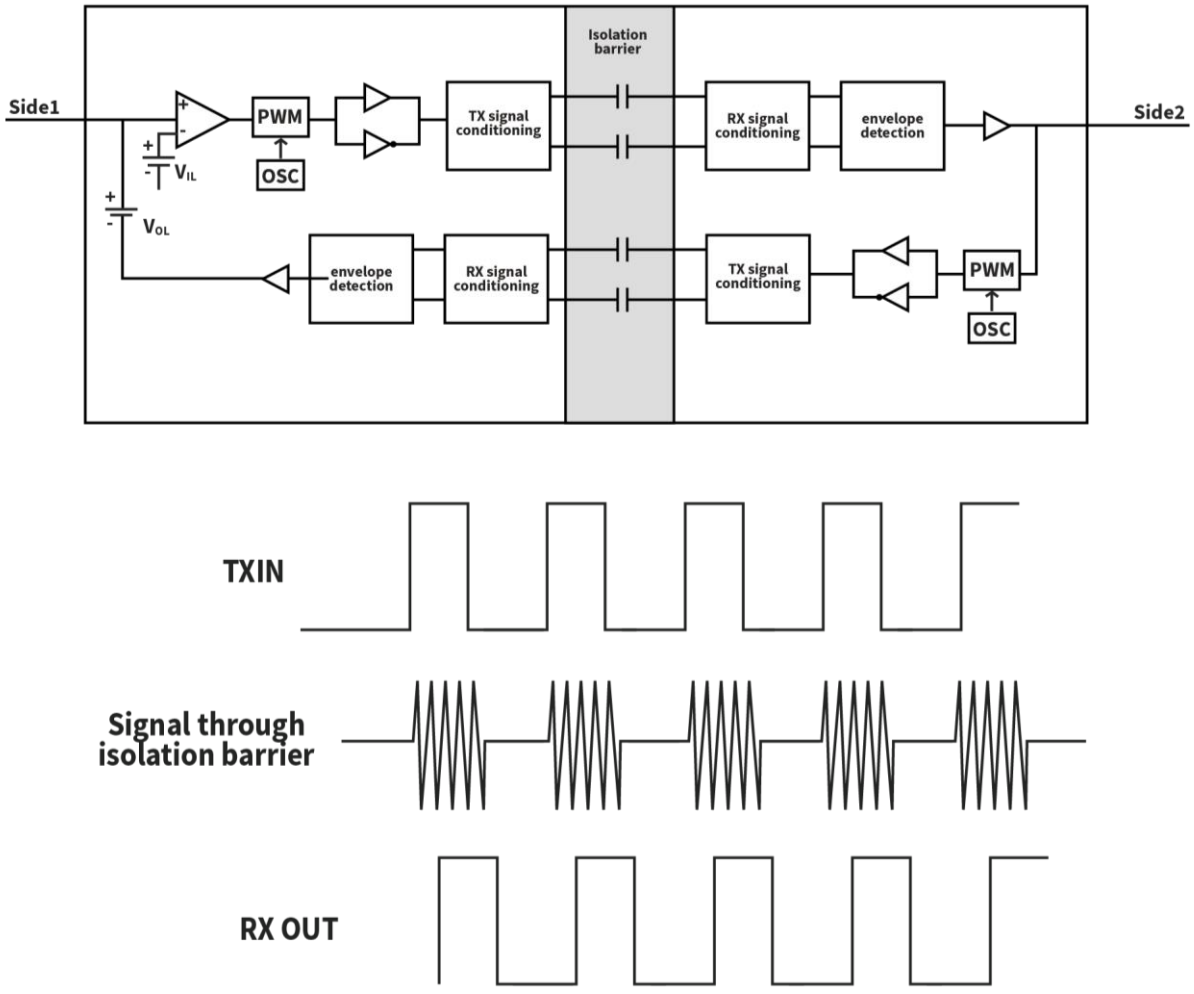


Figure 7.1 Simplified Channel Diagram

Table 7.1 Output status vs. power status

Input	*EN_X*	*VDD1 status*	*VDD2 status*	*Output*	*Comment*
H	H or NC	Ready	Ready	H	Normal operation.
L	H or NC	Ready	Ready	L	
X	L	Ready	Ready	Z	Output Disabled, the output is high impedance
X	H or NC	Unready	Ready	L H	The output follows the same status with the input within 60us after input side VDD1 is powered on.
X	L	Unready	Ready	Z	Output Disabled, the output is high impedance
X	X	Ready	Unready	X	The output follows the same status with the input within 60us after output side VDD2 is powered on.

8. Application Note

8.1. PCB Layout

The NSi814xS 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 5.1 show the recommended schematic diagram , Figure 5.2 to Figure 5.3 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 50 Ω, ±40%. When driving loads where transmission line effects will be a factor, output pins should be appropriately terminated with controlled impedance PCB traces.

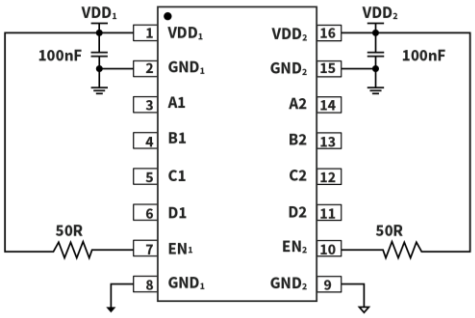


Figure 8.1 Recommended schematic diagram

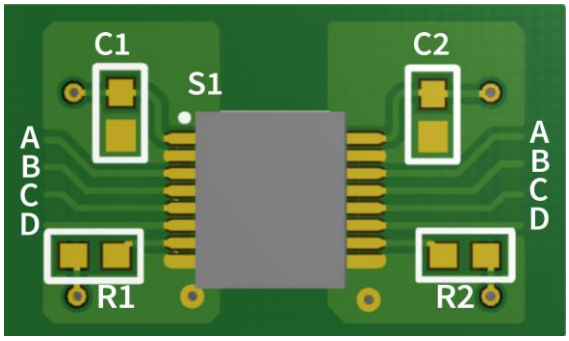


Figure 8.2 Recommended PCB Layout — Top Layer

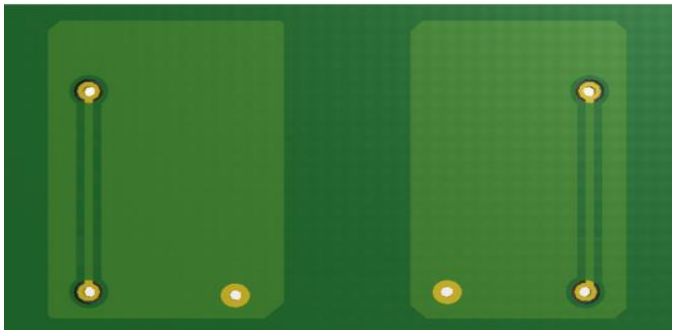


Figure 8.3 Recommended PCB Layout — Bottom Layer

8.2. High Speed Performance

Figure 5.4 shows the eye diagram of NSi814xS at 200Mbps data rate output. The result shows a typical measurement on the NSi814xS with 350ps p-p jitter.

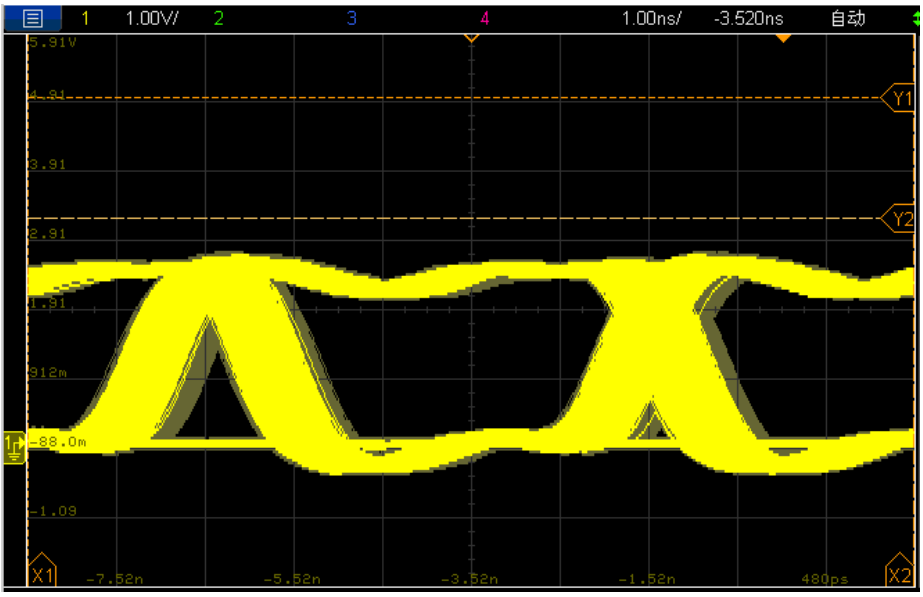


Figure 8.4 NSi814xS Eye Diagram

8.3. Typical Supply Current Equations

The typical supply current of NSi814xS 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

NSi8140S:

$I_{DD1} = 0.19 *a1+1.45*b1+0.82*c1.$

$I_{DD2} = 1.36+ VDD1*f* C_L *c1*10^{-9}$

When a1 is the channel number of low input at side 1, b1 is the channel number of high input at side 1, c1 is the channel number of switch signal input at side 1.

NSi8141S:

$I_{DD1} = 0.87 +1.26*b1+0.63*c1+ VDD1*f* C_L *c2*10^{-9}$

$I_{DD2} = 0.87 +1.26*b2+0.63*c2+ VDD1*f* C_L *c1*10^{-9}$

When b1 is the channel number of high input at side 1, c1 is the channel number of switch signal input at side 1, b2 is the channel number of high input at side 2, c2 is the channel number of switch signal input at side 2.

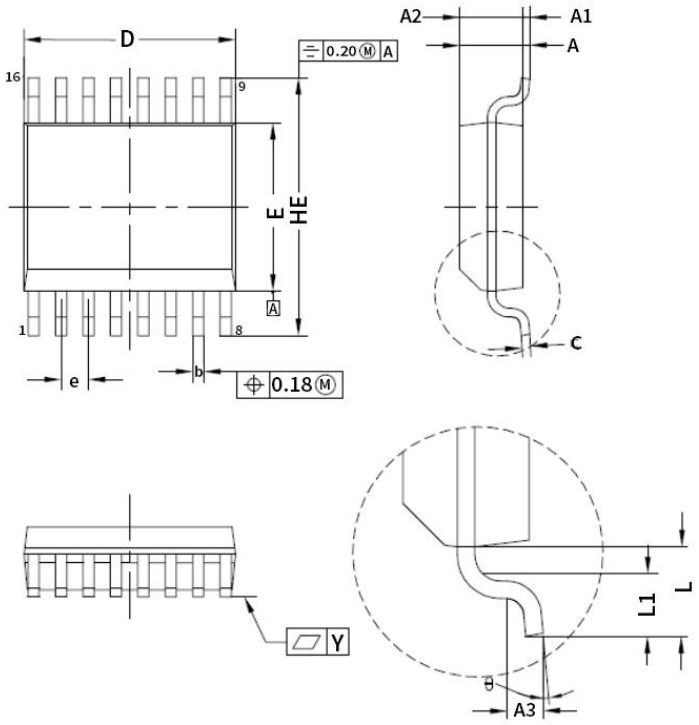
NSi8142S:

$I_{DD1} = 0.87 +1.26*b1+0.63*c1+ VDD1*f* C_L *c2*10^{-9}$

$I_{DD2} = 0.87 +1.26*b2+0.63*c2+ VDD1*f* C_L *c1*10^{-9}$

When b1 is the channel number of high input at side 1, c1 is the channel number of switch signal input at side 1, b2 is the channel number of high input at side 2, c2 is the channel number of switch signal input at side 2.

9. Package Information



* CONTROLLING DIMENSION:MM

SYMBOL	MILLIMETER			INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	---	---	1.73	---	---	0.068
A1	0.10	---	0.25	0.004	---	0.010
A2	1.40	---	1.55	0.055	---	0.061
b	0.20	---	0.31	0.008	---	0.012
c	0.18	---	0.25	0.007	---	0.010
D	4.80	---	5.00	0.189	---	0.197
E	3.80	---	4.00	0.150	---	0.157
HE	5.80	---	6.20	0.228	---	0.244
e	0.635 bsc			0.025 bsc		
L	1.00 bsc			0.039 bsc		
L1	0.41	---	0.89	0.016	---	0.035
Y	---	0.09	---	---	0.004	---
A3	---	0.25	---	---	0.010	---
θ	0^0	---	8^0	0^0	---	8^0

Figure 9.1 SSOP16 Package Shape and Dimension in millimeters

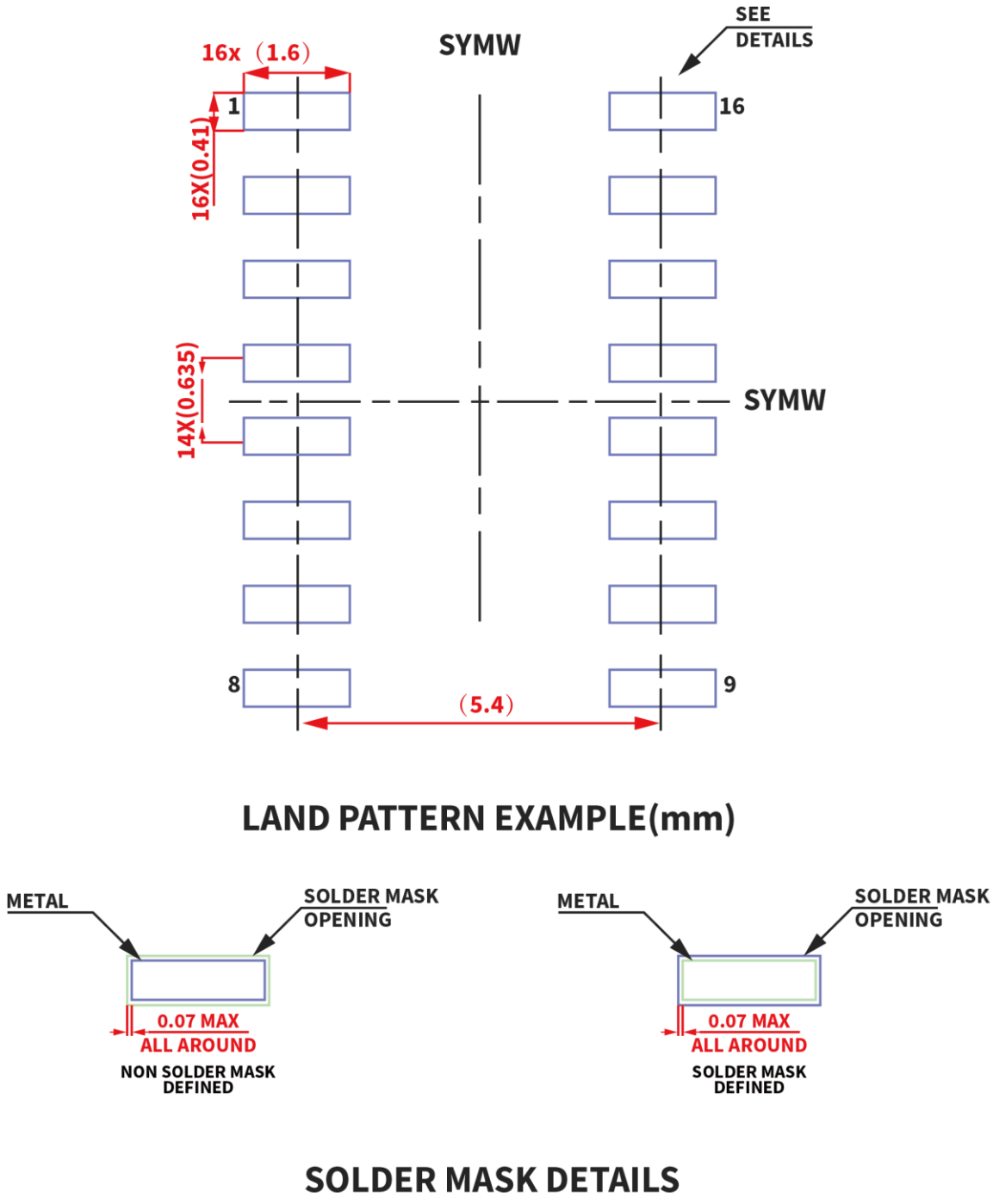
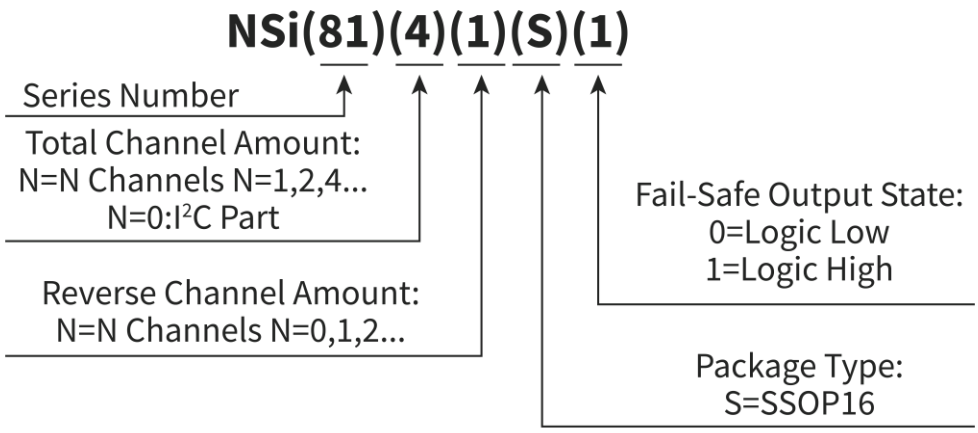


Figure 9.2 SSOP16 Package Board Layout Example

11. Order Information

Part No.	*Isolation Rating(kV)*	*Number of side 1 inputs*	*Number of side 2 inputs*	*Max Data Rate (Mbps)*	*Default Output State*	*MSL level*	*Temperature*	*SPQ*	*Package*
NSi8140S0	3	4	0	150	Low	1	-40 to 125℃	2500	SSOP16
NSi8140S1	3	4	0	150	High	1	-40 to 125℃	2500	SSOP16
NSi8141S0	3	3	1	150	Low	1	-40 to 125℃	2500	SSOP16
NSi8141S1	3	3	1	150	High	1	-40 to 125℃	2500	SSOP16
NSi8142S0	3	2	2	150	Low	1	-40 to 125℃	2500	SSOP16
NSi8142S1	3	2	2	150	High	1	-40 to 125℃	2500	SSOP16
NOTE: All packages are RoHS-compliant with peak reflow temperatures of 260 ℃ according to the JEDEC industry standard classifications and peak solder temperatures.									

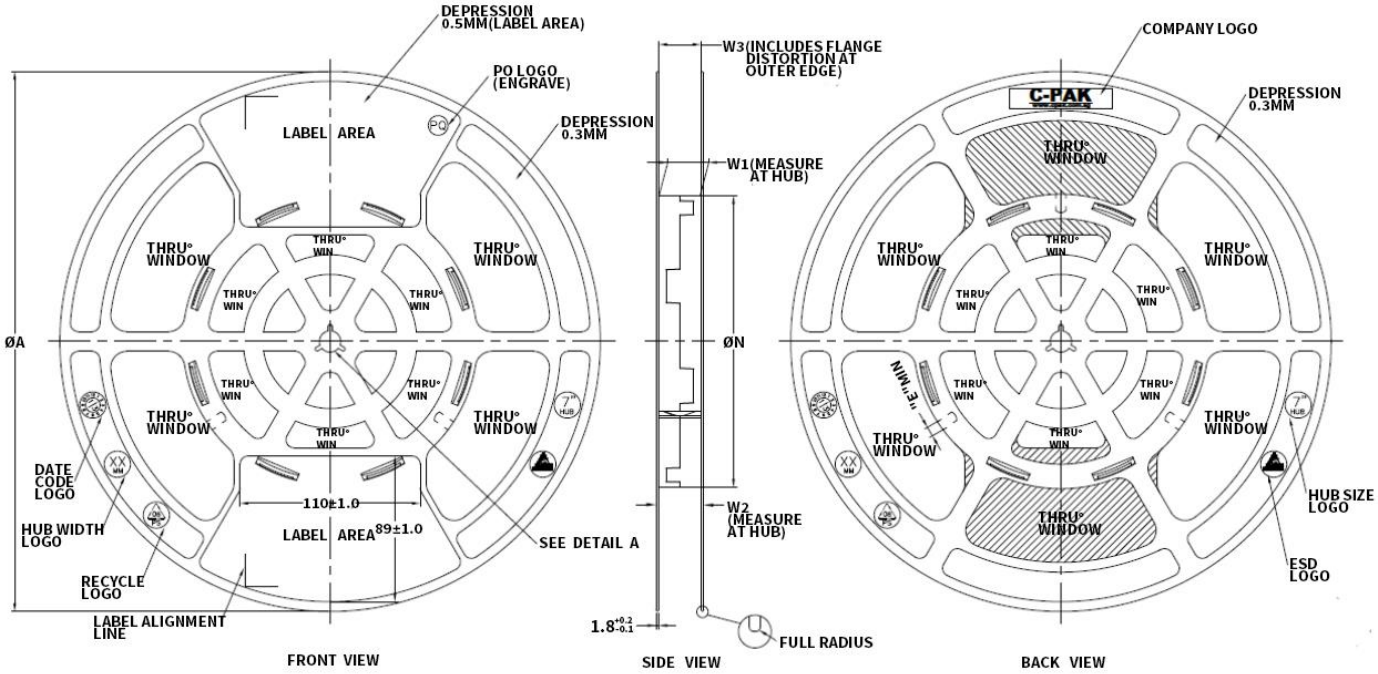
Part Number Rule:

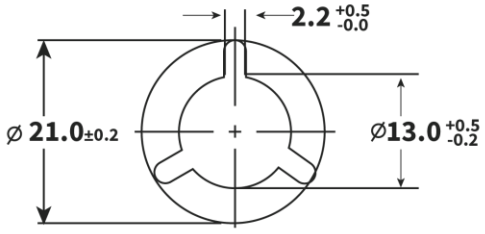


12. Documentation Support

Part Number	*Product Folder*	*Datasheet*	*Technical Documents*	*Isolator selection guide*
NSi814xSx	tbd	tbd	tbd	tbd

13. Tape and Reel Information

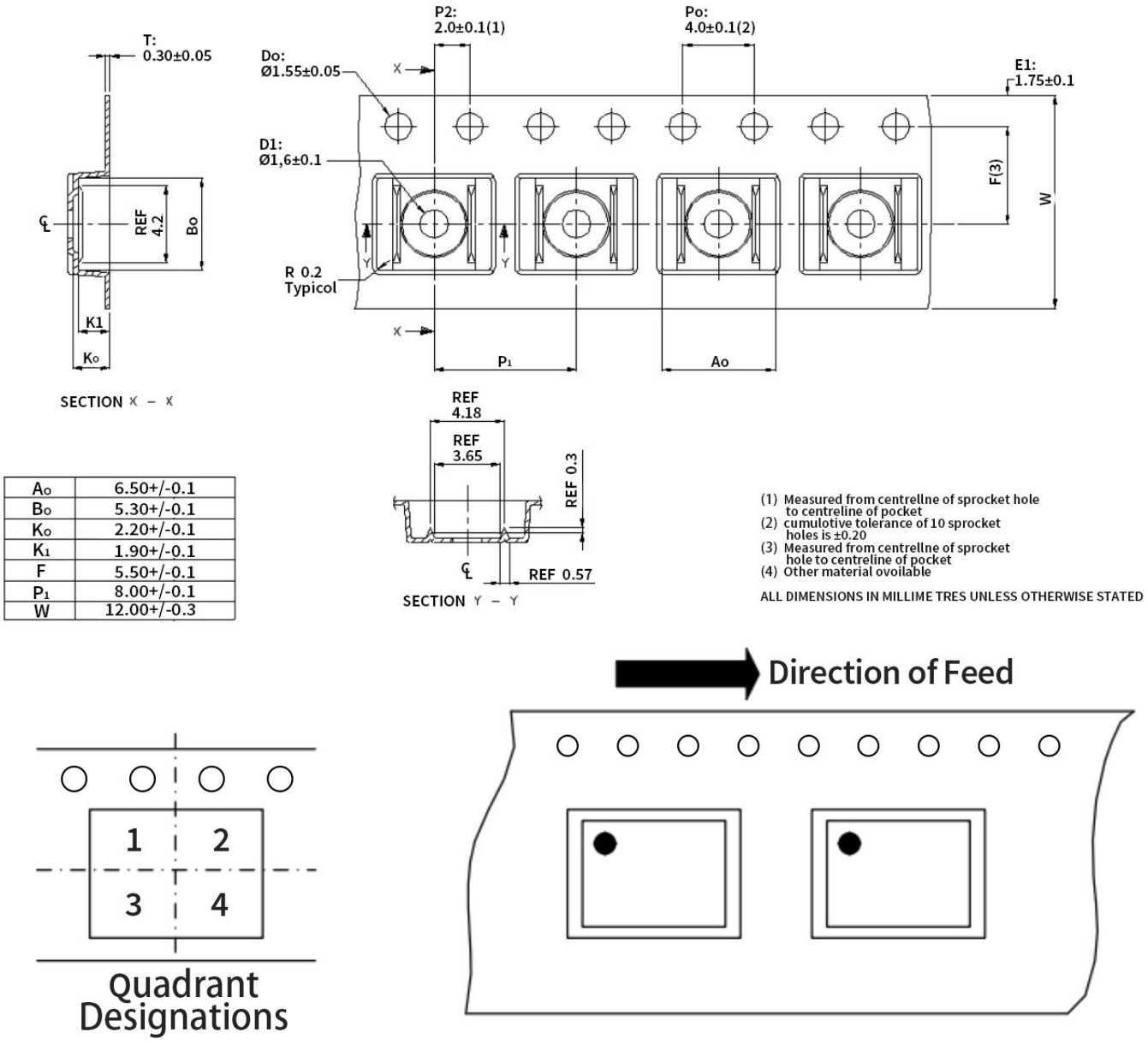




ARBOR HOLE
DETAIL A
SCALE: 3:1

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



A_o	6.50+/-0.1
B_o	5.30+/-0.1
K_o	2.20+/-0.1
K_1	1.90+/-0.1
F	5.50+/-0.1
P_1	8.00+/-0.1
W	12.00+/-0.3

Figure 13.1 Tape and Reel Information of SSOP16

14. Revision History

Revision	*Description*	*Date*
1.0	Initial version	2019/7/15
1.1	Added RecommEnded Operating Conditions AND Thermal Information	2020/6/10
1.2	Update format	2021/2/25
1.3	Added MSL information	2021/3/31
1.4	Corrected part number,Change Storage Temperature	2021/11/20
1.5	Update ssop16 POD	2022/5/16
1.6	Delete Isolation barrier life: >60 years, update Insulation and Safety Related Specifications, add Safety-Limiting Values, delete AEC-Q100 information	2022/9/28

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