

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
- Data rate: DC to 150Mbps
- Power supply voltage: 2.5V to 5.5V
- High CMTI: 150kV/us
- Chip level ESD: HBM: $\pm 6\text{kV}$
- 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: $<15\text{ns}$
- Operation temperature: $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$
- 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

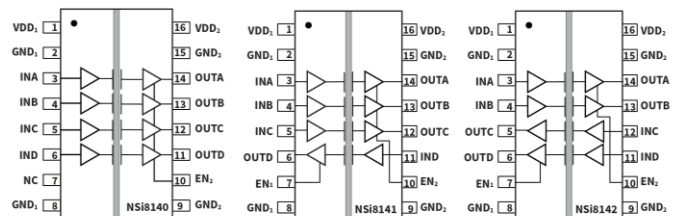


Figure 1. NSi814xS Block Diagram

INDEX

1. PIN CONFIGURATION AND FUNCTIONS	3
2. ABSOLUTE MAXIMUM RATINGS	4
3. RECOMMENDED OPERATING CONDITIONS.....	5
4. THERMAL CHARACTERISTICS	5
5. SPECIFICATIONS	5
5.1. ELECTRICAL CHARACTERISTICS.....	6
5.2. TYPICAL PERFORMANCE CHARACTERISTICS	12
5.3. PARAMETER MEASUREMENT INFORMATION	13
6. HIGH VOLTAGE FEATURE DESCRIPTION	14
6.1. INSULATION AND SAFETY RELATED SPECIFICATIONS.....	14
6.2. SAFETY-LIMITING VALUES	15
6.3. REGULATORY INFORMATION.....	16
7. FUNCTION DESCRIPTION	17
8. APPLICATION NOTE.....	18
8.1. PCB LAYOUT	18
8.2. HIGH SPEED PERFORMANCE	19
8.3. TYPICAL SUPPLY CURRENT EQUATIONS.....	19
9. PACKAGE INFORMATION	20
11. ORDER INFORMATION	22
12. DOCUMENTATION SUPPORT	22
13. TAPE AND REEL INFORMATION.....	23
14. REVISION HISTORY.....	25

1. Pin Configuration and Functions

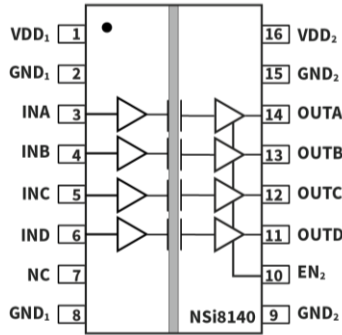


Figure 1.1 NSi8140S Package

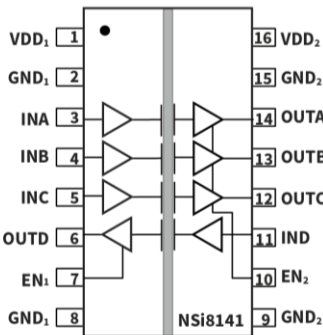


Figure 1.2 NSi8141S Package

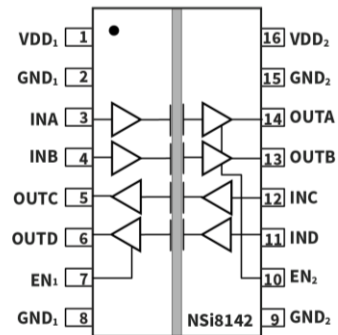


Figure 1.3 NSi8142S Package

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	GND ₂	Ground 2, the ground reference for Isolator Side 2
16	16	16	VDD ₂	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	I _o	-15		15	mA	
Maximum Surge Isolation Voltage	V _{IOSM}			5.3	kV	
Operating Temperature	T _{opr}	-40		125	°C	
Storage Temperature	T _{stg}	-65		150	°C	
Junction temperature	T _j			150	°C	
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	°C
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	°C/W
Junction-to-case(top) thermal resistance	θ_{JB}	54.4	°C/W
Junction-to-board thermal resistance	θ_{JC}	51.9	°C/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°C to 125°C. Unless otherwise noted, Typical values are at VDD1 = 5V, VDD2 = 5V, Ta = 25°C)

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°C to 125°C. Unless otherwise noted, Typical values are at VDD1 = 5V, VDD2 = 5V, Ta = 25°C)

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 t _{PHL} – t _{PLH}	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 , $C_L = 15\text{pF}$
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 , $C_L = 15\text{pF}$, $R_L = 1\text{k}$
Enable to Data high Valid	t_{PZH}		10.00		ns	See Figure 5.10 , $C_L = 15\text{pF}$, $R_L = 1\text{k}$
Disable low to Tri-State	t_{PLZ}		17.25		ns	See Figure 5.10 , $C_L = 15\text{pF}$, $R_L = 1\text{k}$
Enable to Data high Valid	t_{PZL}		10.85		ns	See Figure 5.10 , $C_L = 15\text{pF}$, $R_L = 1\text{k}$

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

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 t _{PHL} – t _{PLH}	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°C to 125°C. Unless otherwise noted, Typical values are at VDD1 = 2.5V, VDD2 = 2.5V, Ta = 25°C)

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 $ t_{PHL} - t_{PLH} $	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

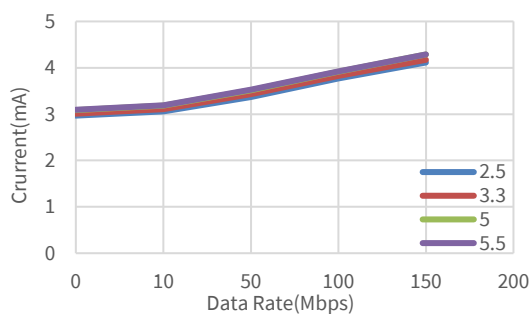


Figure 5.1 NSi8140S VDD1 Supply Current vs Data Rate

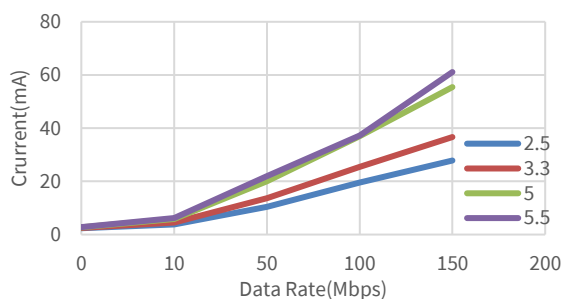


Figure 5.2 NSi8140S VDD2 Supply Current vs Data Rate

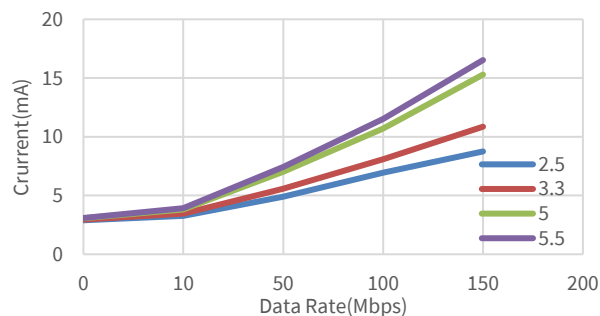


Figure 5.3 NSi8141S VDD1 Supply Current vs Data Rate

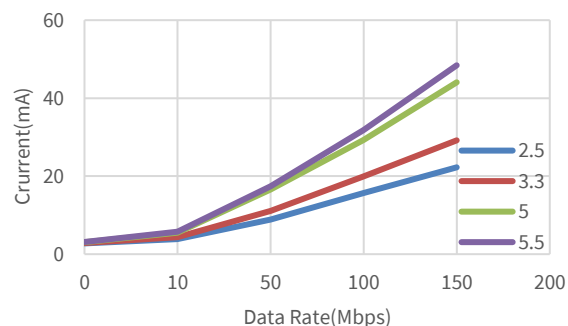


Figure 5.4 NSi8141S VDD2 Supply Current vs Data Rate

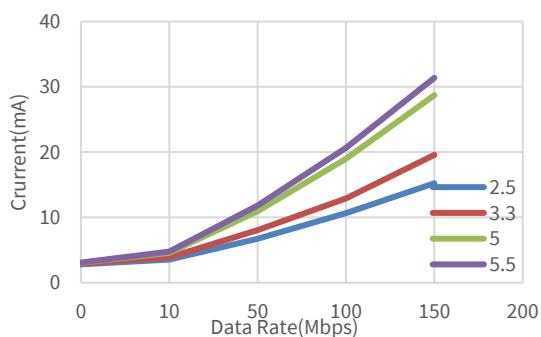


Figure 5.5 NSi8142S VDD1 Supply Current vs Data Rate

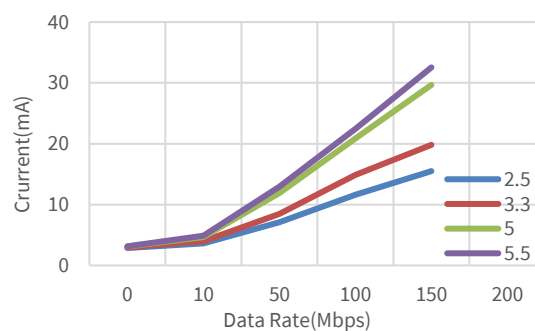


Figure 5.6 NSi8142S VDD2 Supply Current vs Data Rate

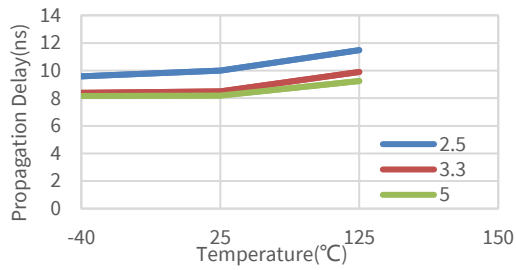


Figure 5.7 Rising Edge Propagation Delay Vs Temp

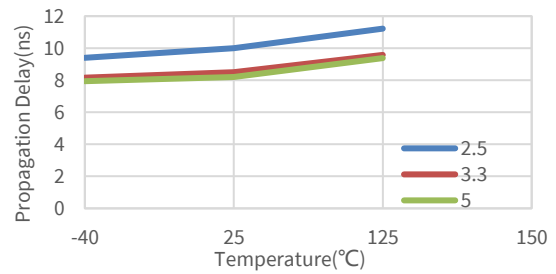


Figure 5.8 Falling Edge Propagation Delay Vs Temp

5.3. Parameter Measurement Information

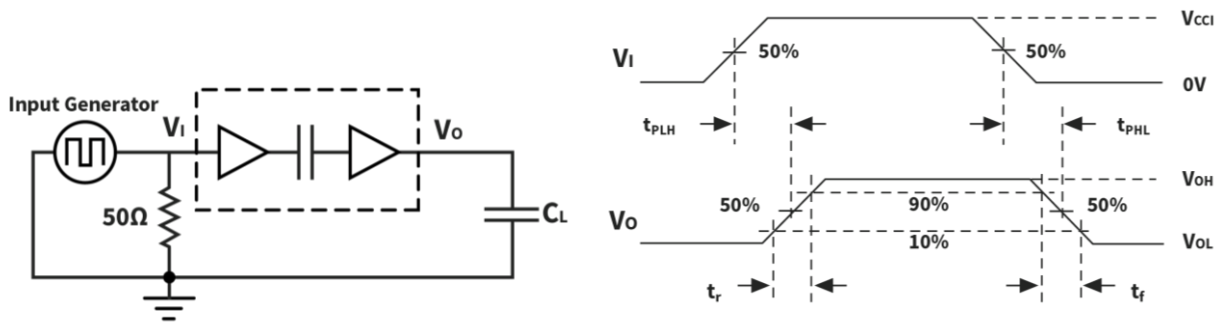


Figure 5.9 Switching Characteristics Test Circuit and Waveform

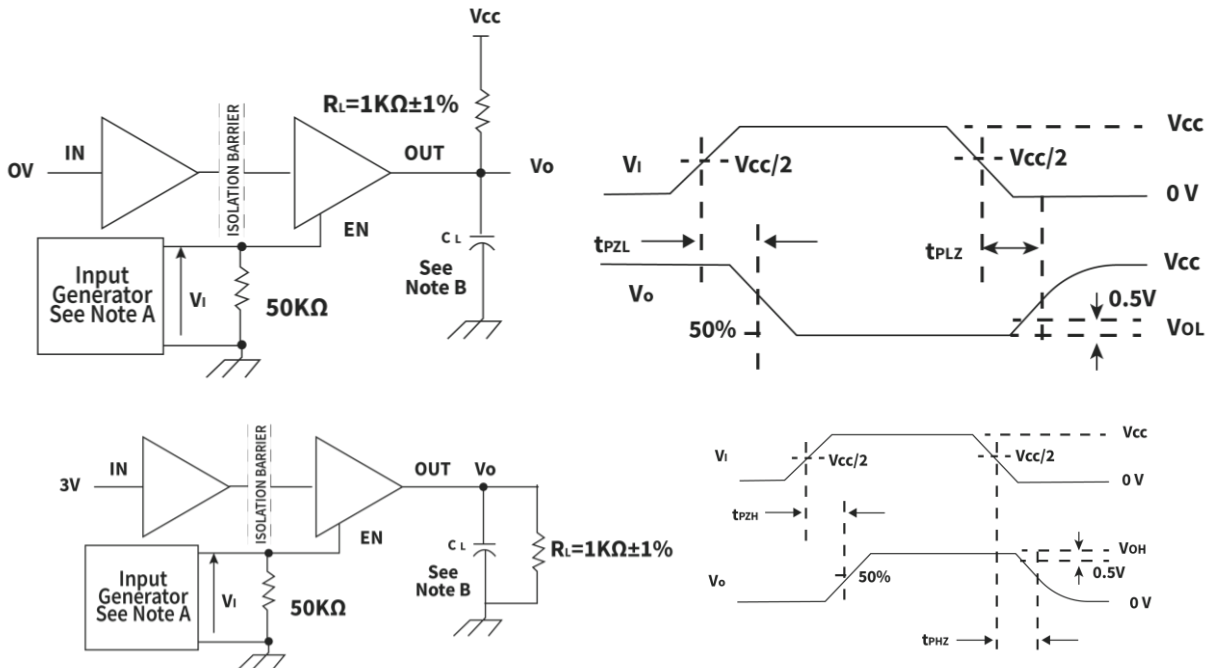


Figure 5.10 Enable/Disable Propagation Delay Time Test Circuit and Waveform

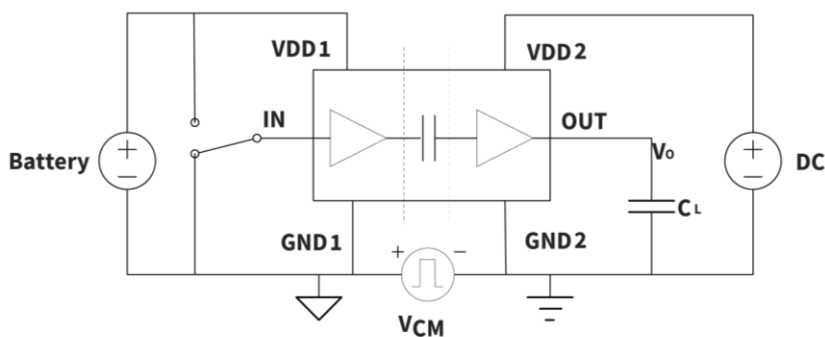


Figure 5.11 Common-Mode Transient Immunity Test Circuit

Note A :The input pulse is supplied by a generator having the following characteristics: PRR $\leq$ 50 kHz, 50% duty cycle, $t_r \leq 3$ ns, $t_f \leq 3$ ns, $Z_o = 50 \Omega$. 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 $\pm 20\%$.

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 $\leq 150V_{rms}$			I to IV	
For Rated Mains Voltage $\leq 300V_{rms}$			I to III	
For Rated Mains Voltage $\leq 400V_{rms}$			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, $V_{TEST} = V_{IOSM} \times 1.3$	VIOSM	5384	Vpeak
Isolation resistance	$V_{IO} = 500V$	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	$R_{\theta JA} = 100^\circ C/W^{1)}$, $T_J = 150^\circ C$, $T_A = 25^\circ C$	1250	mW
Safety Supply Current	$R_{\theta JA} = 100^\circ C/W^{1)}$, $V_I = 5V$, $T_J = 150^\circ C$, $T_A = 25^\circ C$	250	mA
Safety Temperature ²⁾		150	$^\circ C$

- 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.

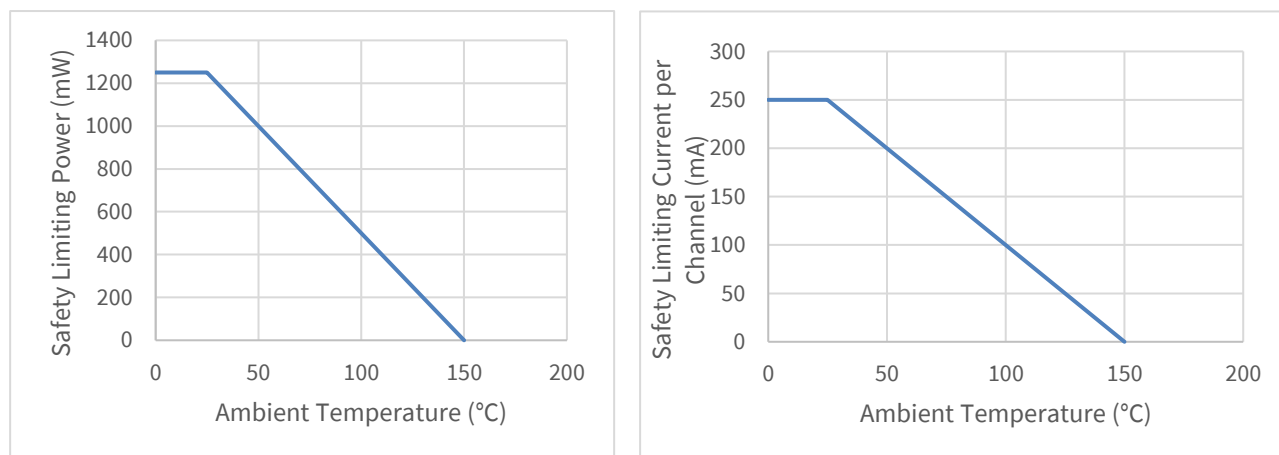


Figure 6.1 NSi8140S/NSi8141S /NSi8142S Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

6.3. Regulatory Information

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

<i>CUL</i>		<i>VDE</i>	<i>CQC</i>
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 565V _{peak} , V _{IOSM} =5384V _{peak}	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 ($3.75\text{kV}_{\text{rms}}$, 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 $150\text{kV}/\mu\text{s}$. 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.

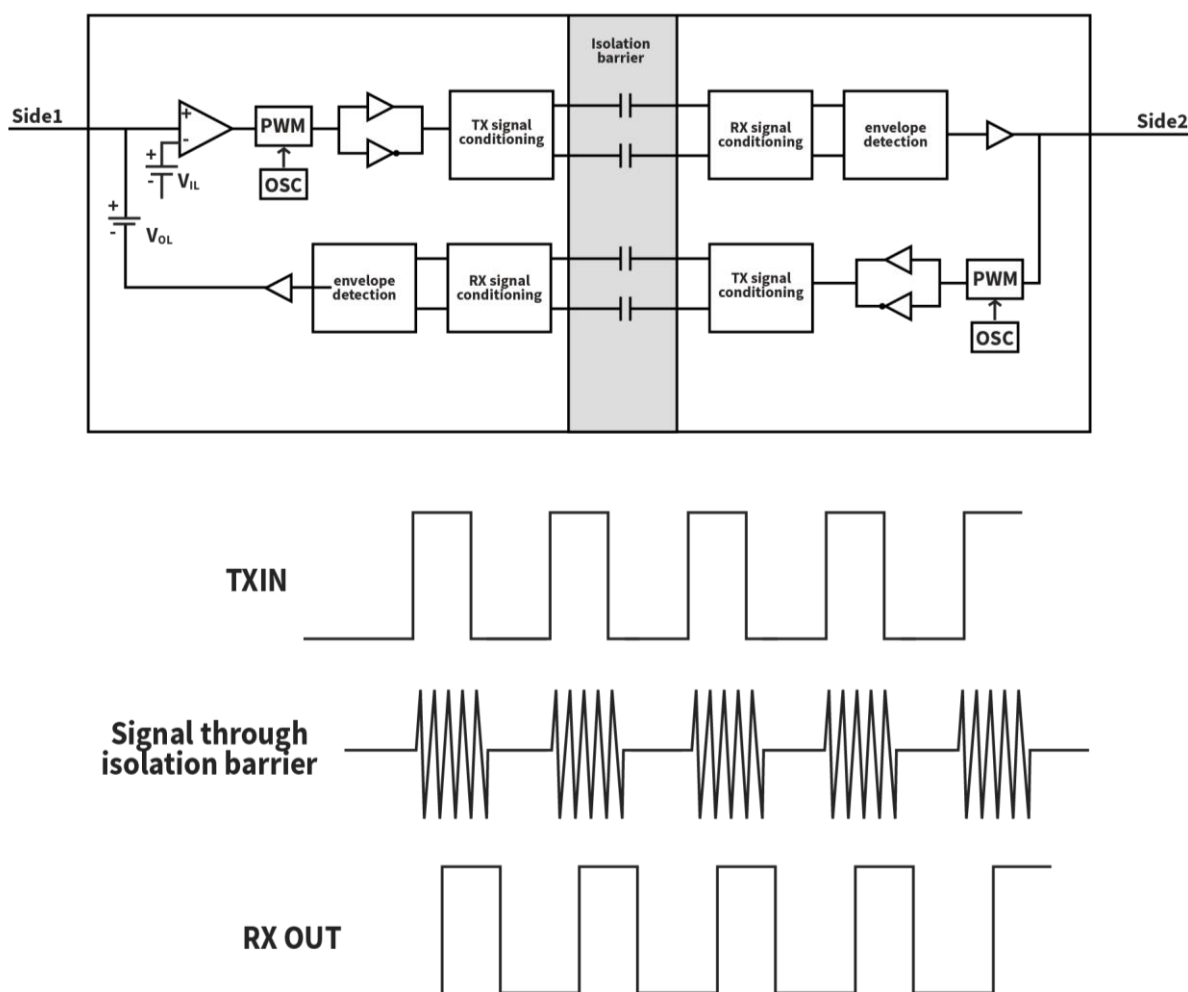


Figure 7.1 Simplified Channel Diagram

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 μ F 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 , $\pm 40\%$. When driving loads where transmission line effects will be a factor, output pins should be appropriately terminated with controlled impedance PCB traces.

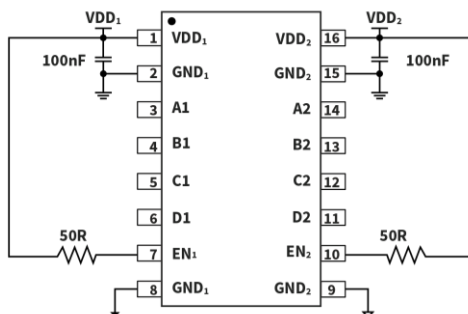


Figure 8.1 Recommended schematic diagram

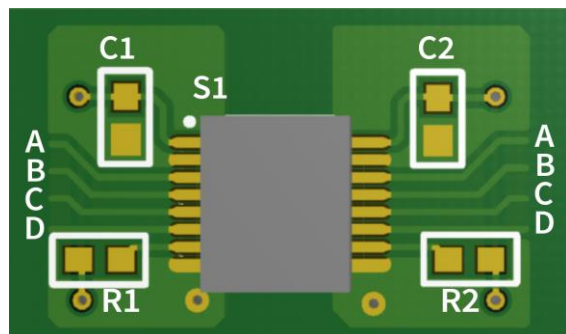


Figure 8.2 Recommended PCB Layout — Top Layer

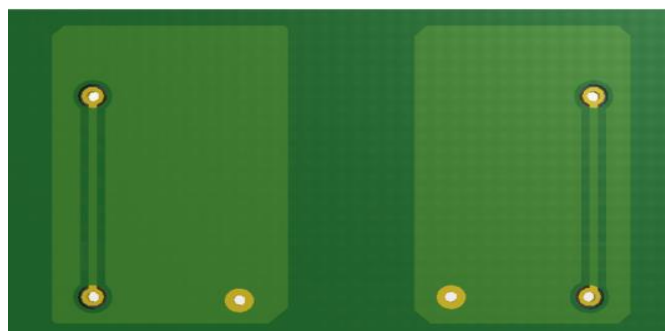


Figure 8.3 Recommended PCB Layout — Bottom Layer

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.

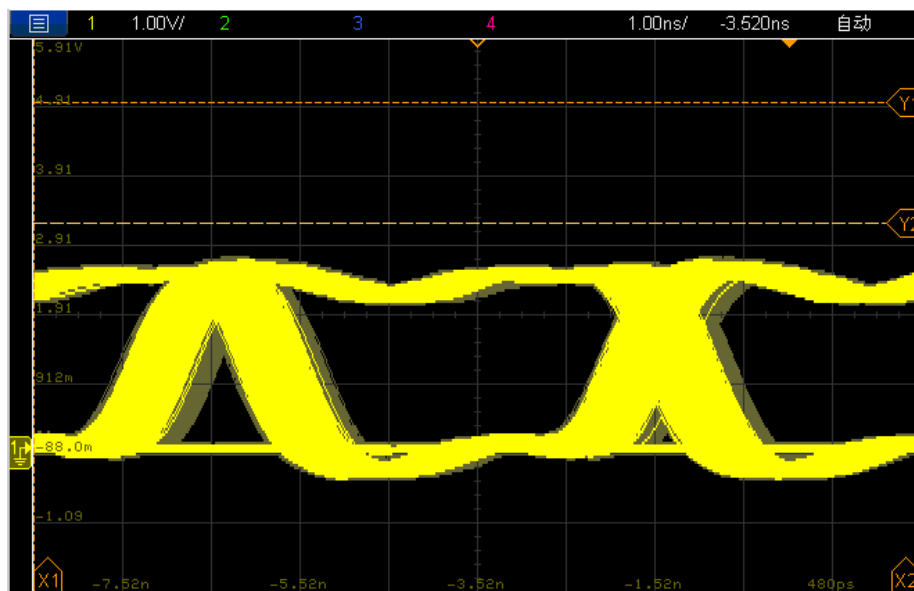


Figure 8.4 NSi814xS Eye Diagram

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.

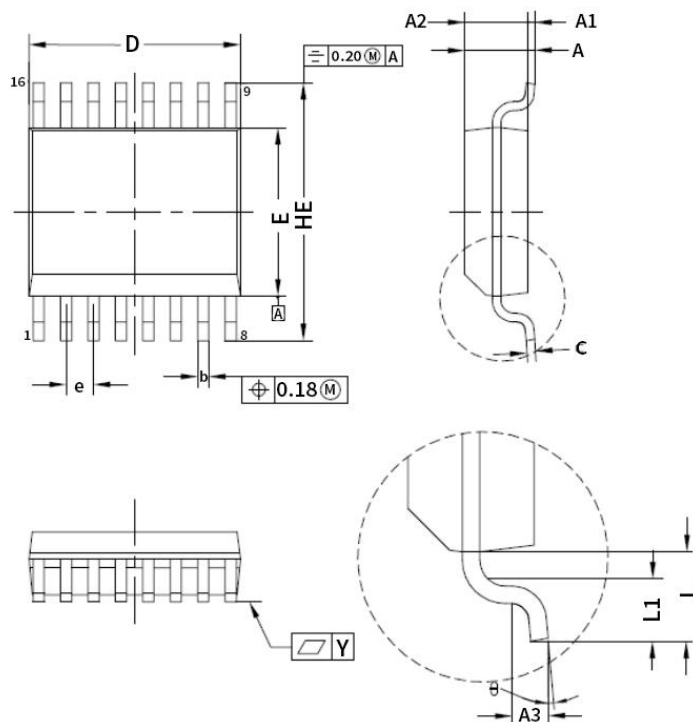
NSi8142S:

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

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

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°	---	8°	0°	---	8°

Figure 9.1 SSOP16 Package Shape and Dimension in millimeters

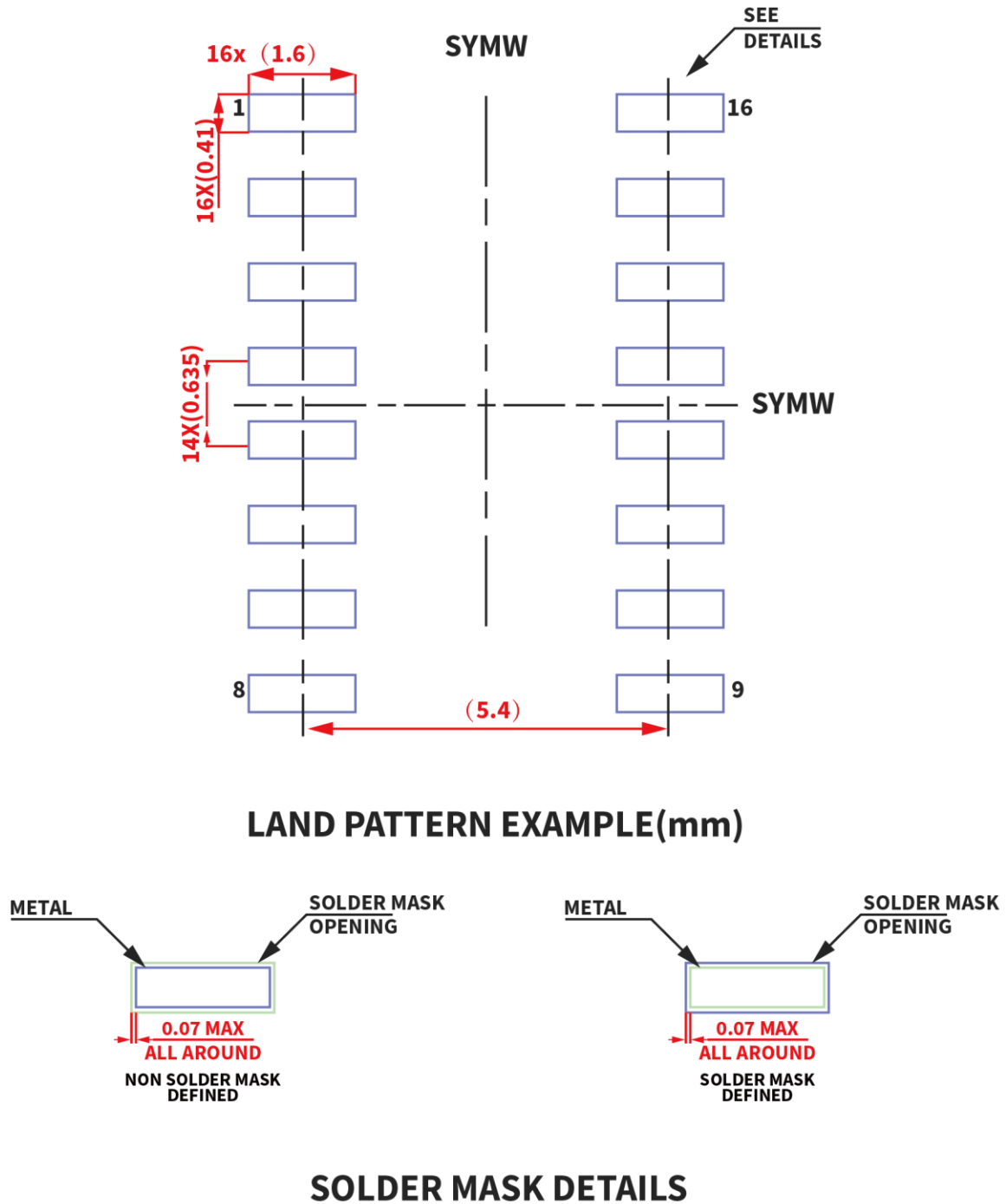


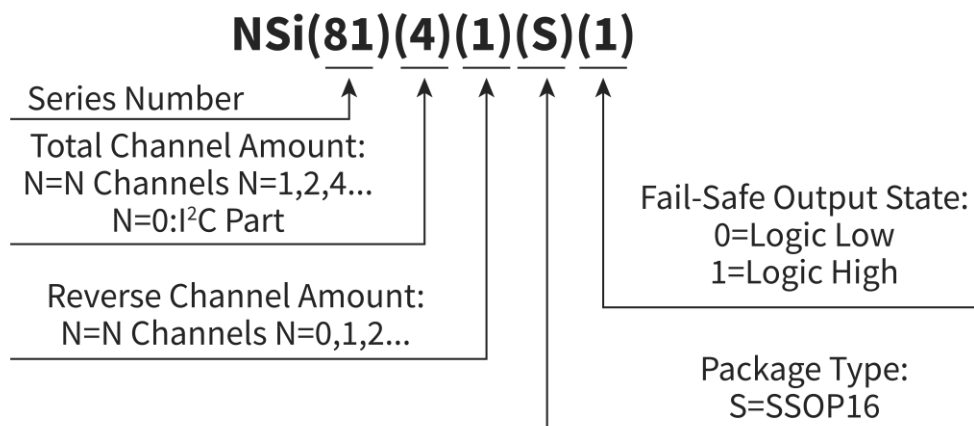
Figure 9.2 SSOP16 Package Board Layout Example

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°C	2500	SSOP16
NSi8140S1	3	4	0	150	High	1	-40 to 125°C	2500	SSOP16
NSi8141S0	3	3	1	150	Low	1	-40 to 125°C	2500	SSOP16
NSi8141S1	3	3	1	150	High	1	-40 to 125°C	2500	SSOP16
NSi8142S0	3	2	2	150	Low	1	-40 to 125°C	2500	SSOP16
NSi8142S1	3	2	2	150	High	1	-40 to 125°C	2500	SSOP16

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

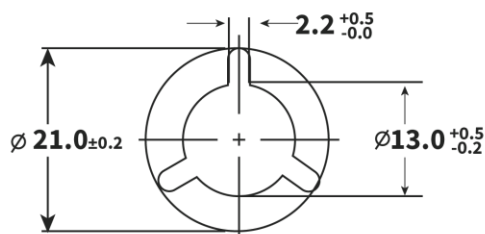
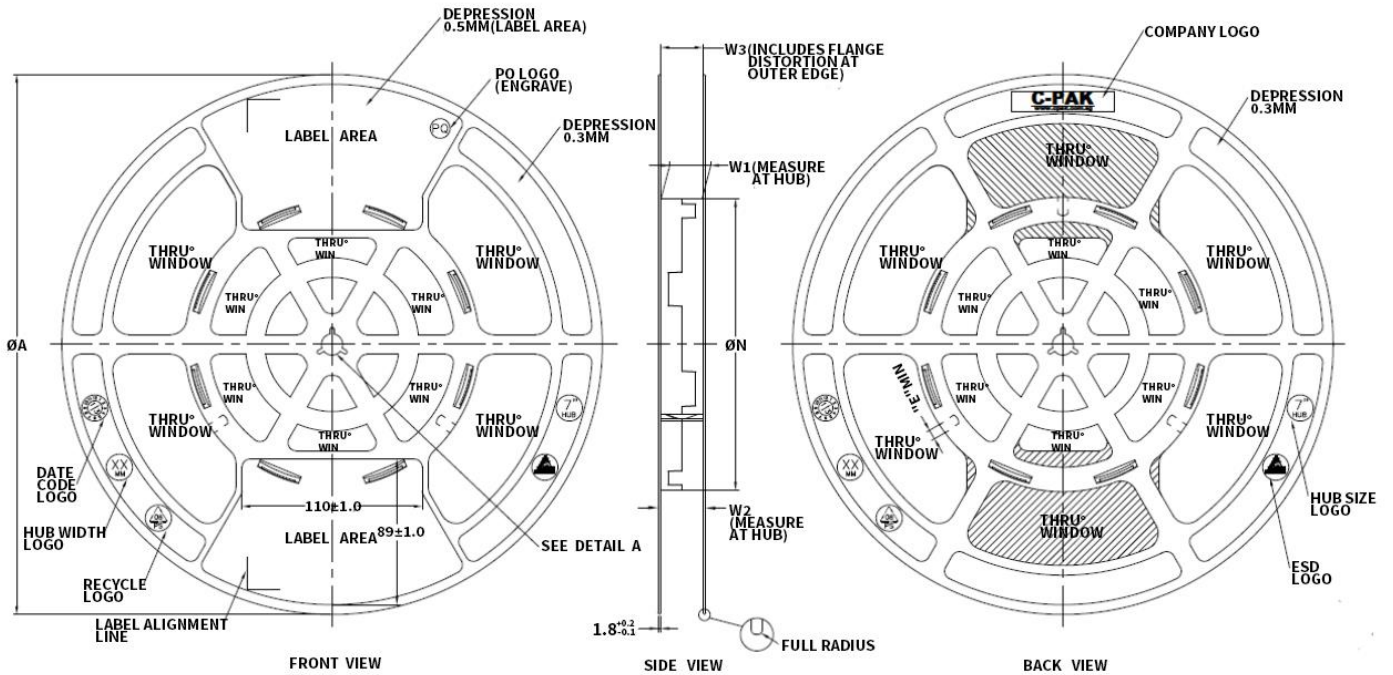
Part Number Rule:



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 INTERFERENCE	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

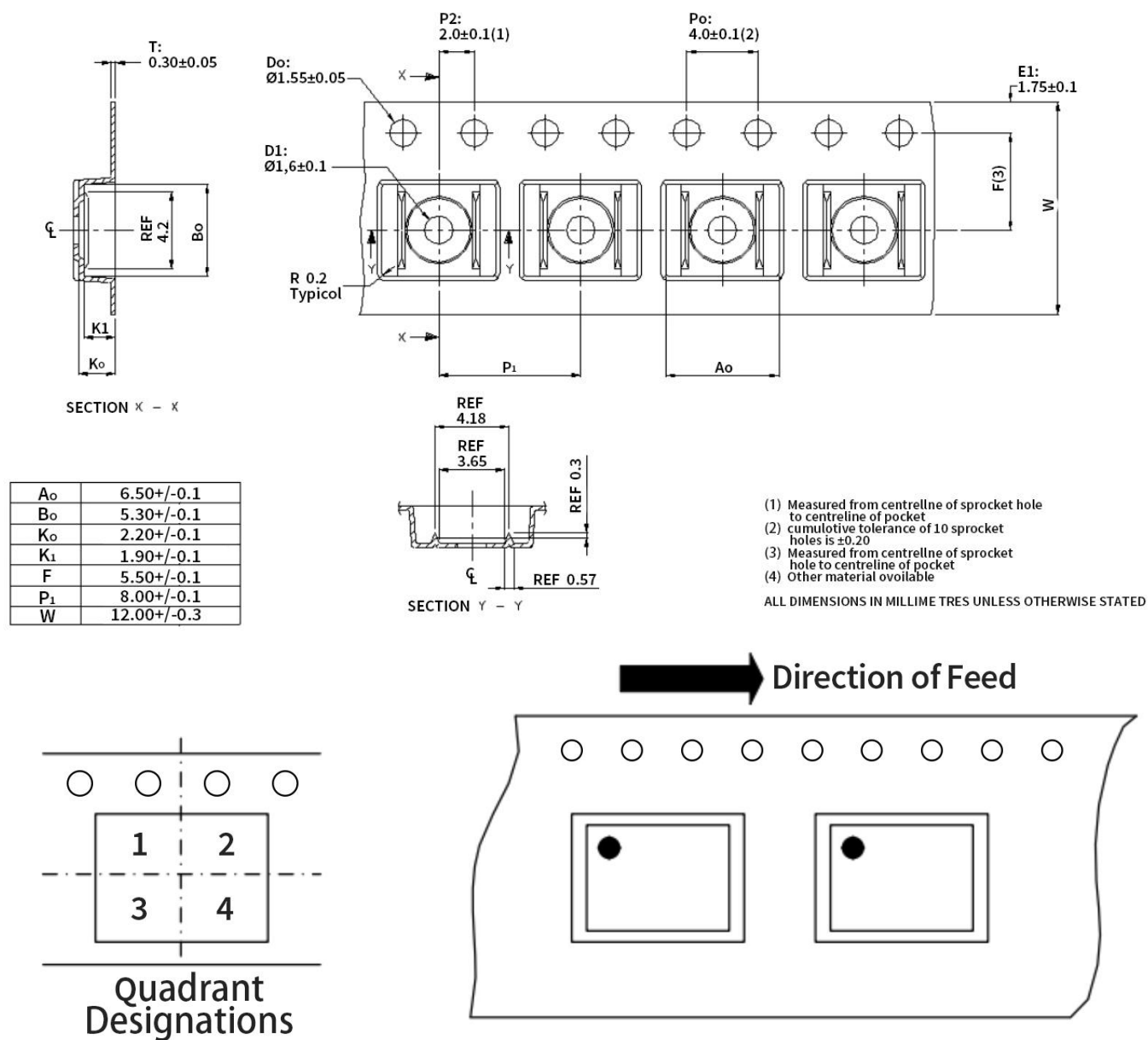


Figure 13.1 Tape and Reel Information of SSOP16

14. Revision History

<i>Revision</i>	<i>Description</i>	<i>Date</i>
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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