

## Product Overview

NSi83085A is a high reliability isolated half duplex RS-485 transceiver based on NOVOSENSE digital isolation technology, while NSi83086A is an isolated full duplex RS-485 transceiver. Both devices are safety certified by UL1577 support  $5kV_{rms}$  insulation withstand voltages, while providing high electromagnetic immunity and low emissions at low power consumption.

The Bus pins of NSi83085A/NSi83086A are protected from  $\pm 10kV$  system level ESD to GND2 on Bus side. These devices feature fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. The devices have a 1/8-unit-load receiver input impedance that allows up to 256 transceivers on the bus.

The data rate of NSi83085A is 500kbps. The device is slew limited to reduce EMI and reflections with improperly terminated transmission line. The data rate of NSi83086A is up to 16Mbps.

## Key Features

- Up to  $5000V_{rms}$  Insulation voltage
- Bus side power supply voltage: 3.0V to 5.5V
- VDD1 supply voltage: 2.5V to 5.5V
- High CMTI:  $\pm 150kV/us$
- High system level EMC performance:  
Bus Pins meet IEC61000-4-2  $\pm 10kV$  ESD
- Fail-safe protection receiver
- NSi83085A has slew rate limitation
- Up to 256 transceivers on the bus
- Isolation Barrier Life: >60 years
- Operation temperature:  $-40^{\circ}C \sim 105^{\circ}C$
- RoHS-compliant packages:  
SOIC-16 wide body



## Safety Regulatory Approvals

- UL recognition: up to  $5000V_{rms}$  for 1 minute per UL1577
- CQC certification per GB4943.1-2011
- CSA component notice 5A
- DIN VDE V 0884-11:2017-01

## Applications

- Industrial automation system
- Isolated RS-485 communication
- Smart electric meter and water meter
- Security and protection monitoring

## Functional Block Diagrams

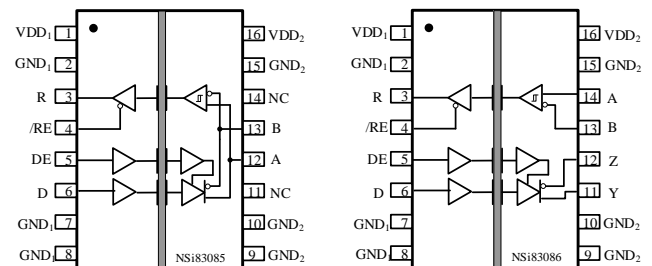


Figure 1. NSi83085A & NSi83086A Block Diagrams

## Index

<b>1.0</b>	<b>ABSOLUTE MAXIMUM RATINGS .....</b>	<b>3</b>
<b>2.0</b>	<b>SPECIFICATIONS .....</b>	<b>3</b>
2.1.	DC ELECTRICAL CHARACTERISTICS .....	3
2.2.	SWITCHING ELECTRICAL CHARACTERISTICS .....	5
2.3.	TYPICAL PERFORMANCE CHARACTERISTICS .....	8
2.4.	PARAMETER MEASUREMENT INFORMATION .....	9
<b>3.0</b>	<b>HIGH VOLTAGE FEATURE DESCRIPTION .....</b>	<b>11</b>
3.1.	INSULATION AND SAFETY RELATED SPECIFICATIONS .....	11
3.2.	DIN VDE V 0884-11 (VDE V 0884-11) :2017-01 INSULATION CHARACTERISTICS .....	11
3.3.	REGULATORY INFORMATION.....	13
<b>4.0</b>	<b>FUNCTION DESCRIPTION .....</b>	<b>13</b>
4.1.	DATA RATE .....	13
4.2.	TRUE FAIL-SAFE RECEIVER INPUTS .....	14
4.3.	TRUTH TABLES .....	14
4.4.	THERMAL SHUTDOWN.....	15
<b>5.0</b>	<b>APPLICATION NOTE .....</b>	<b>15</b>
5.1.	256 TRANSCEIVERS ON THE BUS .....	15
5.2.	ESD PROTECTION .....	15
5.3.	LAYOUT CONSIDERATIONS.....	15
5.4.	TYPICAL APPLICATION .....	15
<b>6.0</b>	<b>PACKAGE INFORMATION .....</b>	<b>17</b>
<b>7.0</b>	<b>TAPE AND REEL INFORMATION .....</b>	<b>19</b>
<b>8.0</b>	<b>ORDER INFORMATION .....</b>	<b>21</b>
<b>9.0</b>	<b>REVISION HISTORY .....</b>	<b>21</b>

## 1.0 ABSOLUTE MAXIMUM RATINGS

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	VDD <sub>1</sub> , VDD <sub>2</sub>	-0.5		6	V	
Maximum Input Voltage	/RE, DE, TxD	-0.4		VDD+0.4	V	
Common-Mode Transients	CMTI	-150		150	kV/us	
Driver Output/Receiver Input Voltage	VA, VB, VY, VZ	-7		12	V	
Differential input voltage, A with respect to B	VID	-15		15	V	
Receiver Output Current	I <sub>o</sub>	-15		15	mA	
Maximum Surge Isolation Voltage	V <sub>IOSM</sub>			5.3	kV	
Operating Temperature	Topr	-40		105	°C	
Storage Temperature	Tstg	-40		150	°C	
Electrostatic discharge	HBM (Bus pins and GND)			±8000	V	
	HBM(All pins)			±6000	V	
	CDM			±2000	V	

## 2.0 SPECIFICATIONS

### 2.1. DC ELECTRICAL CHARACTERISTICS

(VDD<sub>1</sub>=2.5V~5.5V, VDD<sub>2</sub>=3.0V~5.5V, Ta=-40°C to 105°C. Unless otherwise noted, Typical values are at VDD<sub>1</sub> = 5V, VDD<sub>2</sub> = 5V, Ta = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power supply voltage	VDD <sub>1</sub>	2.5		5.5	V	
	VDD <sub>2</sub>	3.0		5.5	V	Bus Side
Logic-side supply current	I <sub>DD1</sub>		3.32	4.98	mA	VDD <sub>1</sub> =5V, DE=high, /RE=D=low, no load
			3.26	4.89	mA	VDD <sub>1</sub> =3V, DE=high, /RE=D=low, no load

Bus-side supply current	I <sub>DD2</sub>		3.35	5.02	mA	VDD <sub>2</sub> =5V, DE=high, /RE=D =low, no load (NSi83085A)
			2.15	3.23	mA	VDD <sub>2</sub> =5V, DE=high, /RE=D =low, no load (NSi83085A)
Thermal-Shutdown Threshold	T <sub>TS</sub>		165		°C	
Thermal-Shutdown Hysteresis	T <sub>TSH</sub>		15		°C	
Common Mode Transient Immunity	CMTI	±100		±150	kV/us	
<b>Logic Side</b>						
Input High Voltage	V <sub>IH</sub>	2			V	DE, D, /RE
Input Low Voltage	V <sub>IL</sub>			0.8	V	DE, D, /RE
Input Threshold	V <sub>IT</sub>		1.6		V	Input Threshold at rising edge
	V <sub>IT_HYS</sub>		0.4		V	Input Threshold Hysteresis
Input Pull up Current	I <sub>PU</sub>			20	uA	DE, /RE
Input Pull down Current	I <sub>PD</sub>	-15			uA	DI
Output Voltage High	V <sub>OH</sub>	VDD <sub>1</sub> - 0.3			V	I <sub>OH</sub> = -4mA
Output Voltage Low	V <sub>OL</sub>			0.3	V	I <sub>OL</sub> = 4mA
Output Short-Circuit Current	I <sub>OSR</sub>			150	mA	0 ≤ V <sub>R</sub> ≤ VDD <sub>1</sub>
Three-State Output Current	I <sub>OZ</sub>	-15			uA	0 ≤ V <sub>R</sub> ≤ VDD <sub>1</sub> , /RE = high
Input Capacitance	C <sub>IN</sub>		2		pF	DE, D, /RE
<b>Driver</b>						
Differential Output Voltage	V <sub>OD</sub>			VDD2	V	No Load
		2.7		VDD2	V	<a href="#">See Figure 2.4.1</a> , R <sub>L</sub> =100Ω (RS-422), VDD2=5V
		1.5		VDD2	V	<a href="#">See Figure 2.4.1</a> , R <sub>L</sub> =100Ω (RS-422), VDD2=3.3V
		2.1		VDD2	V	<a href="#">See Figure 2.4.1</a> , R <sub>L</sub> =54Ω (RS-485), VDD2=5V
		1.3		VDD2	V	<a href="#">See Figure 2.4.1</a> , R <sub>L</sub> =54Ω (RS-485), VDD2=3.3V

Change in magnitude of the differential output voltage	$\Delta V_{OD} $			0.2	V	<a href="#">See Figure 2.4.1</a> , $R_L=100\Omega$ or $R_L=54\Omega$
Common-Mode Output Voltage	$ V_{OC} $		$VDD_2/2$	3	V	<a href="#">See Figure 2.4.1</a> , $R_L=100\Omega$ or $R_L=54\Omega$
Change in Magnitude of Common-Mode Voltage	$\Delta V_{OC} $			0.2	V	<a href="#">See Figure 2.4.1</a> , $R_L=100\Omega$ or $R_L=54\Omega$
Driver Short-Circuit Output Current	$I_{OSD}$			250	mA	$0 \leq V_{OUT} \leq +12\text{ V}$
		-250			mA	$-7V \leq V_{OUT} \leq VDD_2$
Output Leakage Current (Y and Z) Full-Duplex	$I_O$			125	$\mu A$	DE=GND, $V_{IN}=12V$
		-75			$\mu A$	DE=GND, $V_{IN}=-7V$
Receiver						
Input Current (A and B)	$I_A, I_B$			125	$\mu A$	DE=GND, $VDD_2=GND$ , $V_{IN}=12V$
		-200			$\mu A$	DE=GND, $VDD_2=GND$ , $V_{IN}=-7V$
Receiver Differential Threshold Voltage	$V_{TH}$	-200	-125	-50	mV	$-7V \leq V_{CM} \leq 12V$
Receiver Input Hysteresis	$\Delta V_{TH}$		15		mV	$V_A+V_B=0$
Receiver Input Resistance	$R_{IN}$	96			k $\Omega$	$-7V \leq V_{CM} \leq 12V$ , DE=low

## 2.2. SWITCHING ELECTRICAL CHARACTERISTICS

( $VDD_1=2.5V \sim 5.5V$ ,  $VDD_2=3.0V \sim 5.5V$ ,  $T_a=-40^\circ C$  to  $105^\circ C$ . Unless otherwise noted, Typical values are at  $VDD_1 = 5V$ ,  $VDD_2 = 5V$ ,  $T_a = 25^\circ C$ )

Parameters	Symbol	Min	Typ	Max	Unit	Comments
<b>Driver (NSi83085A)</b>						
Maximum Data Rate	$f_{MAX}$	0.5			Mbps	
Driver Propagation Delay	$t_{PLH}$		450	675	ns	<a href="#">See Figure 2.4.2,</a> <a href="#"><math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
	$t_{PHL}$		430	645	ns	<a href="#">See Figure 2.4.2,</a> <a href="#"><math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
Driver Pulse Width Distortion, $ t_{PHL} - t_{PLH} $	PWD		20		ns	<a href="#">See Figure 2.4.2,</a> <a href="#"><math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>

Driver Output Falling Time or Rising time	$t_F$		590	885	ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
	$t_R$		590	885	ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
Driver Enable to Output High	$t_{ZH}$		310	465	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
Driver Enable to Output Low	$t_{ZL}$		310	465	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
Driver Output High to Disable	$t_{HZ}$		30	45	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
Driver Output Low to Disable	$t_{LZ}$		30	45	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
<b>Receiver (NSi83085A)</b>						
Maximum Data Rate	$f_{MAX}$	0.5			Mbps	
Receiver Propagation Delay	$t_{PLH}$		102	153	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
	$t_{PHL}$		92	138	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
Receiver Pulse Width Distortion	PWD		10		ns	$ t_{PHL} - t_{PLH} $ , <a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
Receiver Output Falling Time or Rising time	$t_F$		2.5	3.75	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
	$t_R$		2.5	3.75	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
Receiver Enable to Output High	$t_{ZH}$		18.5	27.75	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
Receiver Enable to Output Low	$t_{ZL}$		18.5	27.75	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
Receiver Disable to Output High	$t_{HZ}$		23	34.5	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
Receiver Disable to Output Low	$t_{LZ}$		23	34.5	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
<b>Driver (NSi83086A)</b>						
Maximum Data Rate	$f_{MAX}$	16			Mbps	
Driver Propagation Delay	$t_{PLH}$		12	18	ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
	$t_{PHL}$		13.5	20.25	ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>

Driver Pulse Width Distortion, $ t_{PHL} - t_{PLH} $	PWD		1.5		ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
Driver Output Falling Time or Rising time	$t_F$		2.95	4.425	ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
	$t_R$		2.6	3.9	ns	<a href="#">See Figure 2.4.2, <math>R_L=54\Omega</math>, <math>C_L=50pF</math></a>
Driver Enable to Output High	$t_{ZH}$		18.5	27.75	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
Driver Enable to Output Low	$t_{ZL}$		19.1	28.65	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
Driver Disable to Output High	$t_{HZ}$		20.8	31.2	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
Driver Disable to Output Low	$t_{LZ}$		20.1	30.15	ns	<a href="#">See Figure 2.4.3, <math>R_L=110\Omega</math>, <math>C_L=50pF</math></a>
<b>Receiver (NSi83086A)</b>						
Maximum Data Rate	$f_{MAX}$	16			Mbps	
Receiver Propagation Delay	$t_{PLH}$		16.2	24.3	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
	$t_{PHL}$		22.2	33.3	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
Receiver Pulse Width Distortion, $ t_{PHL} - t_{PLH} $	PWD		6.0		ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
Receiver Output Falling Time or Rising time	$t_F$		2.3	3.45	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
	$t_R$		2.1	3.15	ns	<a href="#">See Figure 2.4.4, <math>C_L=15pF</math></a>
Receiver Enable to Output High	$t_{ZH}$		13.8	20.7	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
Receiver Enable to Output Low	$t_{ZL}$		12.6	18.9	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
Receiver Disable to Output High	$t_{HZ}$		14	21	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>
Receiver Disable to Output Low	$t_{LZ}$		13.4	20.1	ns	<a href="#">See Figure 2.4.5, <math>R_L=1k\Omega</math>, <math>C_L=15pF</math></a>

## 2.3. TYPICAL PERFORMANCE CHARACTERISTICS

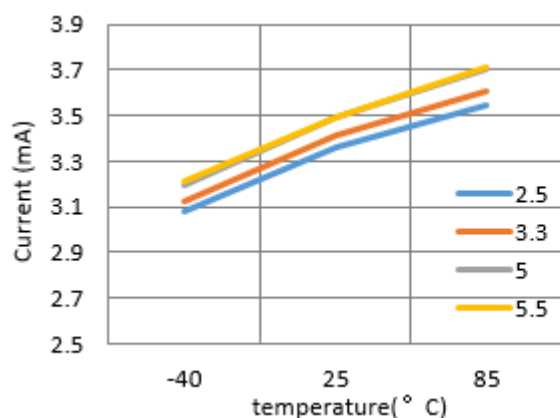


Figure 2.1 NSi83085A VDD1 supply current vs Temperature

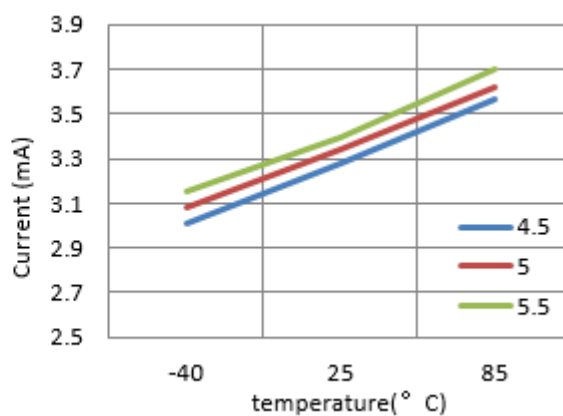


Figure 2.2 NSi83085A VDD2 supply current vs Temperature

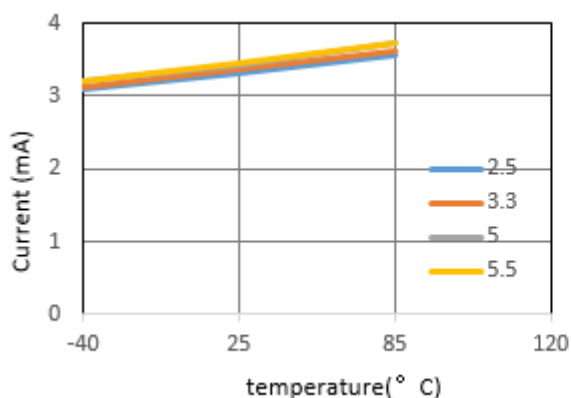


Figure 2.3 NSi83086A VDD1 supply current vs Temperature

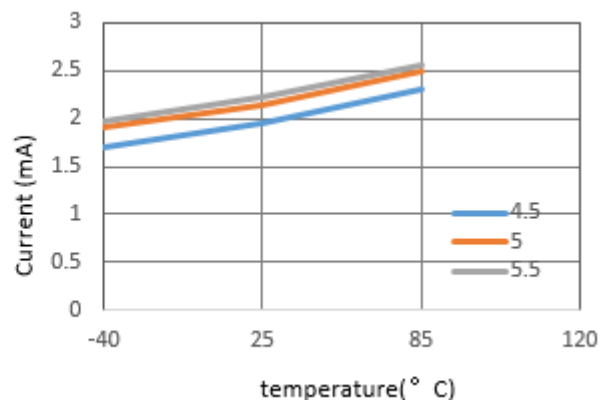


Figure 2.4 NSi83086A VDD2 supply current vs Temperature

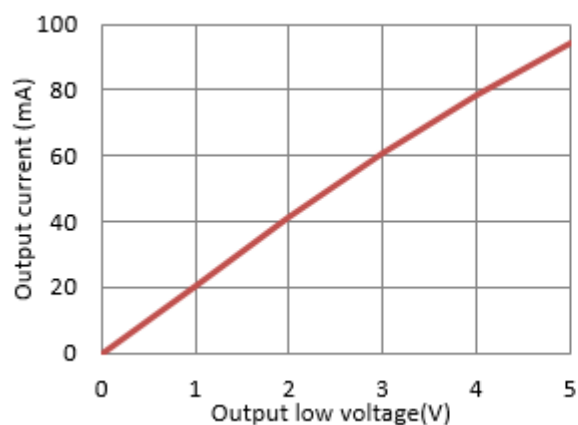


Figure 2.5 Receiver output current vs Output low voltage

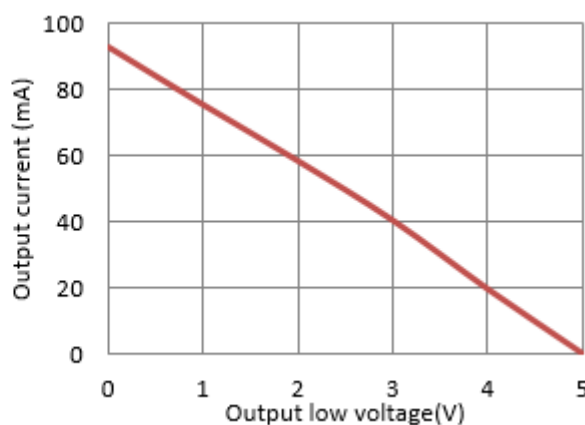


Figure 2.6 Receiver output current vs Output High voltage

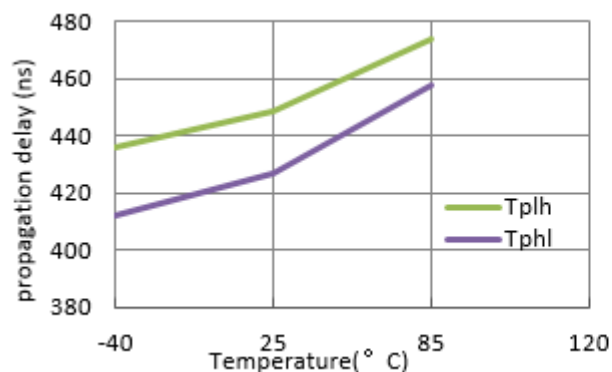


Figure 2.9 NSi83085A Transmitter Propagation Delay vs Temperature

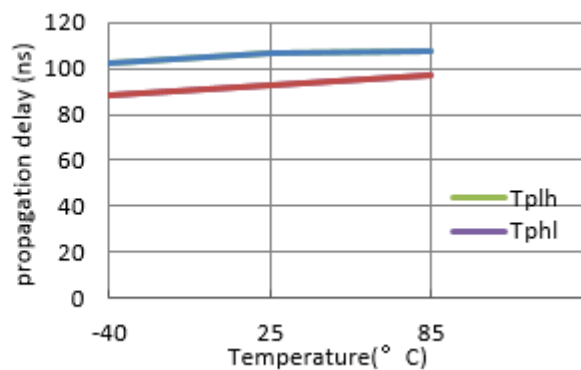


Figure 2.10 NSi83085A Receiver Propagation Delay vs Temperature

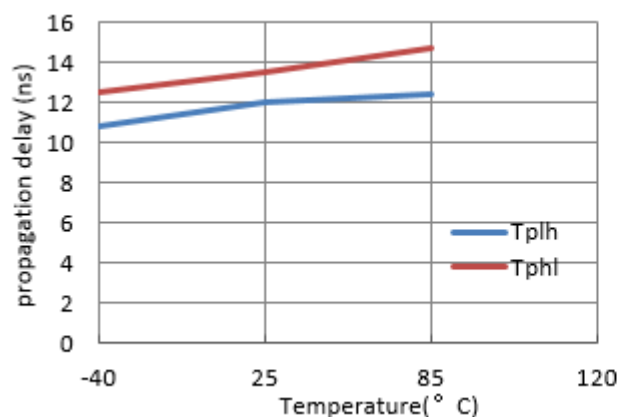


Figure 2.11 NSi83086A Transmitter Propagation Delay vs Temperature

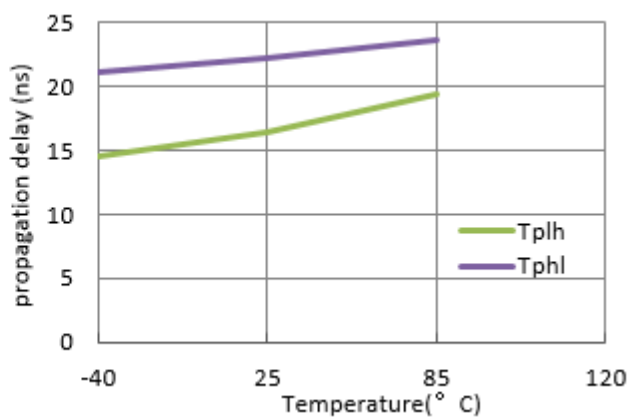


Figure 2.12 NSi83086A Receiver Propagation Delay vs Temperature

## 2.4. PARAMETER MEASUREMENT INFORMATION

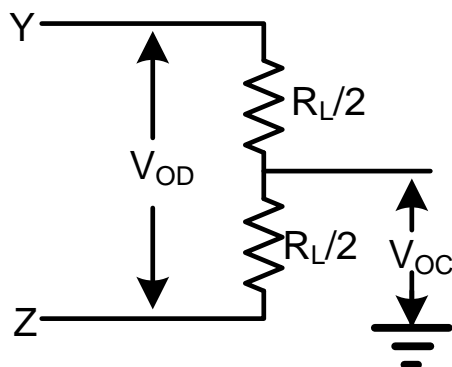


Figure 2.4.1 Driver DC Test Load

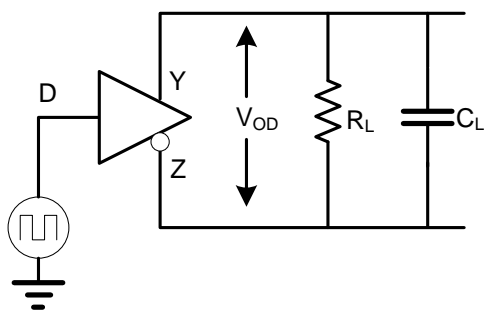


Figure 2.4.2 Driver Timing Test Circuit and waveform

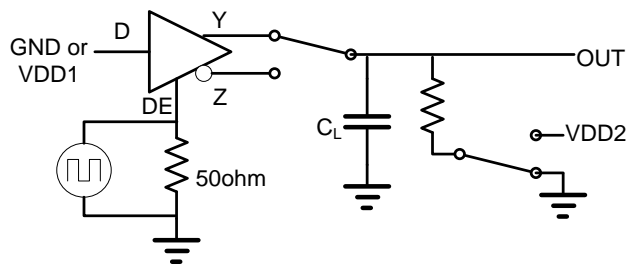


Figure 2.4.3 Driver Enable Disable Timing Test Circuit and waveform

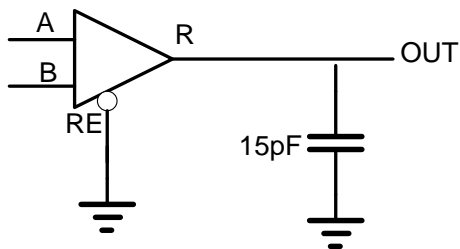


Figure 2.4.4 Receiver Propagation Delay Test Circuit and waveform

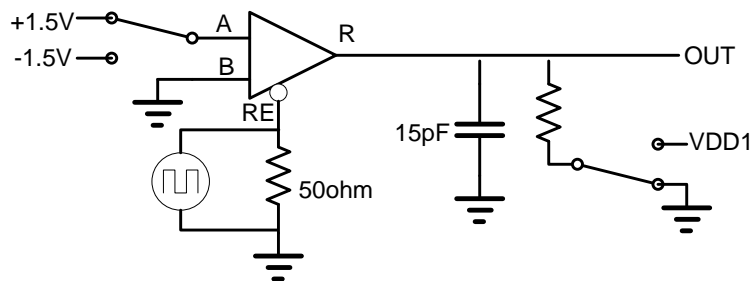


Figure 2.4.5 Receiver Enable Disable Timing Test Circuit and waveform

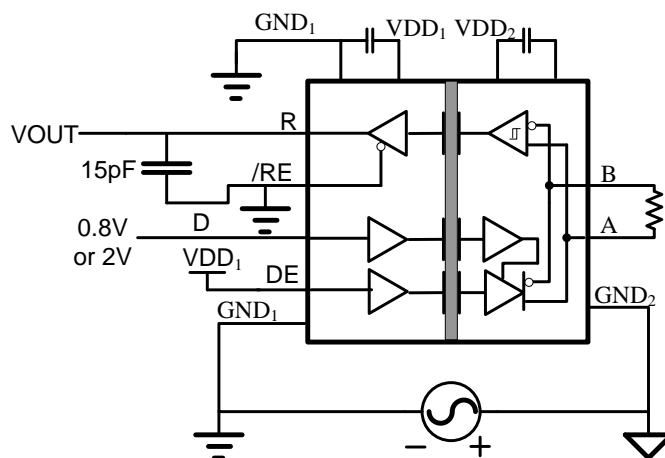


Figure 2.4.6 Common-Mode Transient Immunity Test Circuit

## 3.0 HIGH VOLTAGE FEATURE DESCRIPTION

### 3.1. INSULATION AND SAFETY RELATED SPECIFICATIONS

Parameters	Symbol	Value	Unit	Comments
Minimum External Air Gap (Clearance)	L(I01)	8.0	mm	Shortest terminal-to-terminal distance through air
Minimum External Tracking (Creepage)	L(I02)	8.0	mm	Shortest terminal-to-terminal distance across the package surface
Minimum internal gap	DTI	20	um	Distance through insulation
Tracking Resistance(Comparative Tracking Index)	CTI	>400	V	DIN EN 60112 (VDE 0303-11); IEC 60112
Material Group		II		

### 3.2. DIN VDE V 0884-11 (VDE V 0884-11) :2017-01 INSULATION CHARACTERISTICS

Description	Test Condition	Symbol	Value	Unit
Installation Classification per DIN VDE 0110				
For Rated Mains Voltage $\leq 150\text{Vrms}$			I to IV	
For Rated Mains Voltage $\leq 300\text{Vrms}$			I to IV	

For Rated Mains Voltage $\leq 400V_{rms}$			I to IV	
Climatic Classification			10/105/21	
Pollution Degree per DIN VDE 0110, Table 1			2	
Maximum repetitive isolation voltage	AC Voltage(Bipolar)	$V_{IORM}$	1166	$V_{peak}$
	AC Voltage(Tddb)	$V_{IORM}$	824	$V_{rms}$
	DC Voltage	$V_{IORM}$	1166	$V_{dc}$
Input to Output Test Voltage, Method B1	$V_{IORM} \times 1.5 = V_{pd(m)}$ , 100% production test, $t_{ini} = t_m = 1 \text{ sec}$ , partial discharge $< 5 \text{ pC}$	$V_{pd(m)}$	1749	$V_{peak}$
Input to Output Test Voltage, Method A				
After Environmental Tests Subgroup 1	$V_{IORM} \times 1.2 = V_{pd(m)}$ , $t_{ini} = 60 \text{ sec}$ , $t_m = 10 \text{ sec}$ , partial discharge $< 5 \text{ pC}$	$V_{pd(m)}$	1399	$V_{peak}$
After Input and /or Safety Test Subgroup 2 and Subgroup 3	$V_{IORM} \times 1.2 = V_{pd(m)}$ , $t_{ini} = 60 \text{ sec}$ , $t_m = 10 \text{ sec}$ , partial discharge $< 5 \text{ pC}$	$V_{pd(m)}$	1399	$V_{peak}$
Maximum transient isolation voltage	$t = 60 \text{ sec}$	$V_{IOTM}$	7000	$V_{peak}$
Maximum Surge Isolation Voltage	Test method per IEC60065,1.2/50us waveform, $V_{TEST}=1.3 \times V_{IOSM}$	$V_{IOSM}$	5384	$V_{peak}$
Isolation resistance	$V_{IO}=500V$	$R_{IO}$	$>10^9$	$\Omega$
Isolation capacitance	$f = 1MHz$	$C_{IO}$	0.6	pF
Input capacitance		$C_I$	2	pF
Total Power Dissipation at 25°C		$P_s$	1499	mW
	$\theta_{JA} = 84 \text{ }^\circ\text{C/W}$ , $V_I = 5.5 \text{ V}$ , $T_J = 150 \text{ }^\circ\text{C}$ , $T_A = 25 \text{ }^\circ\text{C}$		237	mA
Case Temperature		$T_s$	150	$^\circ\text{C}$

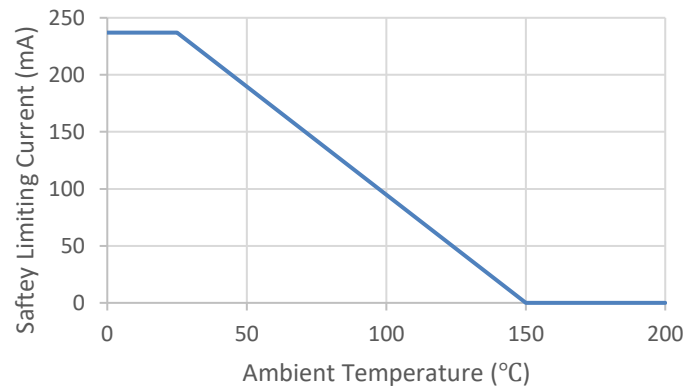


Figure 3.1 NSi83085A/NSi83086A Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

## 3.3. REGULATORY INFORMATION

The NSi83085A/NSi83086A are approved or pending approval by the organizations listed in table.

CUL		VDE	CQC
UL 1577 Component Recognition Program <sup>1</sup>	Approved under CSA Component Acceptance Notice 5A	DIN VDE V 0884-11(VDE V 0884-11):2017-01 <sup>2</sup>	Certified by CQC11-471543-2012 GB4943.1-2011
Single Protection, 5000Vrms Isolation voltage	Single Protection, 5000Vrms Isolation voltage	Basic Insulation 1166Vpeak, $V_{IOSM}=5384V_{peak}$	Basic insulation at 824V <sub>RMS</sub> (1166Vpeak) Reinforced insulation at 400V <sub>RMS</sub> (565Vpeak)
File (E500602)	File (E500602)	File (5024579-4880-0001)	File (pending)

<sup>1</sup> In accordance with UL 1577, each NSi83085A/NSi83086A is proof tested by applying an insulation test voltage  $\geq 6000$  V rms for 1 sec.

<sup>2</sup> In accordance with DIN VDE V 0884-11, each NSi8100W/NSi8101W is proof tested by applying an insulation test voltage  $\geq 1273$  V peak for 1 sec (partial discharge detection limit = 5 pC). The \* marking branded on the component designates DIN VDE V 0884-11 approval.

## 4.0 FUNCTION DESCRIPTION

NSi83085A is a high reliability isolated half duplex RS-485 transceiver, while NSi83086A is an isolated full duplex RS-485 transceiver. Data isolation is achieved using Novosense integrated capacitive isolation that allows data transmission between the logic side and the Bus side. Both devices are safety certified by UL1577 support 5kV<sub>RMS</sub> insulation withstand voltages.

### 4.1. DATA RATE

The data rate of NSi83085A is 500kbps. The device is slew limited to reduce EMI and reflections with improperly terminated transmission line. The data rate of NSi83086A is up to 16Mbps.

## 4.2. TRUE FAIL-SAFE RECEIVER INPUTS

The devices feature fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. The receiver threshold is fixed between -50mV and -200mV, which meets EIA/TIA-485 standard. If the differential input voltage ( $V_A - V_B$ ) is greater than or equal to -50mV, receiver output R is logic high. In the case of a terminated bus with all transmitters disabled, the differential input voltage is pulled to zero by the termination resistors. Due to the receiver threshold, the receiver output R is logic high.

## 4.3. TRUTH TABLES

Table 4.1 Driver Function Table

VDD1 status	VDD2 status	Input (D)	Enable Input (DE)	Outputs <sup>1</sup>	
				A/Y	B/Z
PU	PU	H	H	H	L
PU	PU	L	H	L	H
PU	PU	X	L	Z	Z
PU	PU	X	OPEN	Z	Z
PU	PU	OPEN	H	H	L
PD	PU	X	X	Z	Z
PU	PD	X	X	Z	Z
PD	PD	X	X	Z	Z

<sup>1</sup> PD= Powered down; PU= Powered up; H= Logic High; L= Logic Low; X= Irrelevant; Z= High Impedance; Driver output pins are Y and Z for NSi83086A, A and B for NSi83085A;

Table 4.2 Receiver Function Table<sup>1</sup>

VDD1 status	VDD2 status	Differential Input ( $V_A - V_B$ )	Enable Input (/RE)	Output (R)
PU	PU	$\geq -50\text{mV}$	L/Open	H
PU	PU	$\leq -200\text{mV}$	L/Open	L
PU	PU	Open/Short	L/Open	H
PU	PU	X	H	Z
PU	PU	Idle	L	H
PD	PU	X	X	Z
PU	PD	X	X	H
PD	PD	X	X	Z

<sup>1</sup> PD= Powered down; PU= Powered up; H= Logic High; L= Logic Low; X= Irrelevant; Z= High Impedance.

## 4.4. THERMAL SHUTDOWN

The device is protected from over temperature damage by integrated thermal shutdown circuitry. When the junction temperature ( $T_J$ ) exceeds  $+165^{\circ}\text{C}$  (typ), the driver outputs go high-impedance. The device resumes normal operation when  $T_J$  falls below  $+145^{\circ}\text{C}$  (typ).

## 5.0 APPLICATION NOTE

### 5.1. 256 TRANSCEIVERS ON THE BUS

The devices have a 1/8-unit-load receiver input impedance ( $96\text{k}\Omega$ ) that allows up to 256 transceivers on the bus. Connect any combination of these devices, and/or other RS-485 devices, for a maximum of 32 unit-loads to the line.

### 5.2. ESD PROTECTION

ESD protection structures are enhanced on all pins to protect against electrostatic discharge encountered during handling and assembly. The Bus pins have extra protection against static electricity to both the logic side (VDD1 side) and bus side (VDD2 side).

ESD protection can be tested in various ways. Below is the ESD spec of the devices.

Bus pins:

- $\pm 8\text{kV}$  HBM.
- $\pm 10\text{kV}$  using the Contact Discharge method specified in IEC 61000-4-2

Other pins except bus pins:

- $\pm 6\text{kV}$  HBM.
- $\pm 7\text{kV}$  using the Contact Discharge method specified in IEC 61000-4-2

### 5.3. LAYOUT CONSIDERATIONS

The NSi83085A/NSi83086A requires a  $0.1\text{ }\mu\text{F}$  bypass capacitor between VDD and GND. The capacitor should be placed as close as possible to the package. To eliminate line reflections, each cable end is terminated with a resistor, whose value matches the characteristic impedance of the cable. It's good practice to have the bus connectors and termination resistor as close as possible to the A and B, Y and Z pins.

### 5.4. TYPICAL APPLICATION

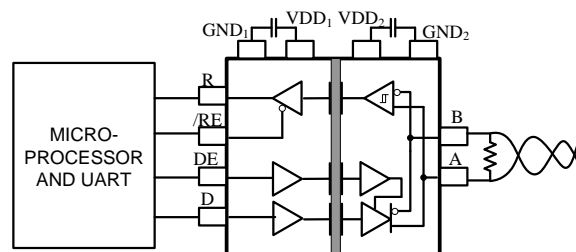


Figure 5.1 NSi83085A typical application circuit

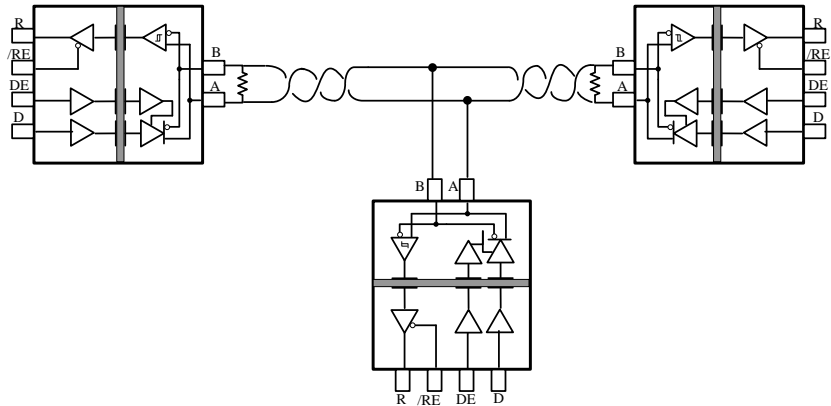


Figure 5.2 Typical isolated Half-Duplex RS-485 application

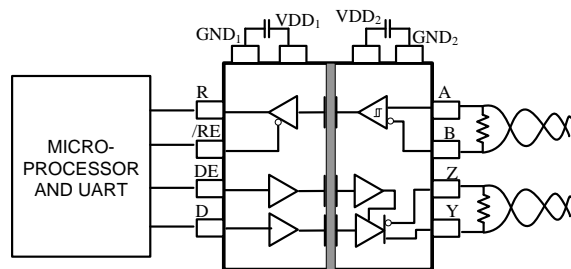


Figure 5.3 NSi83086A typical application circuit

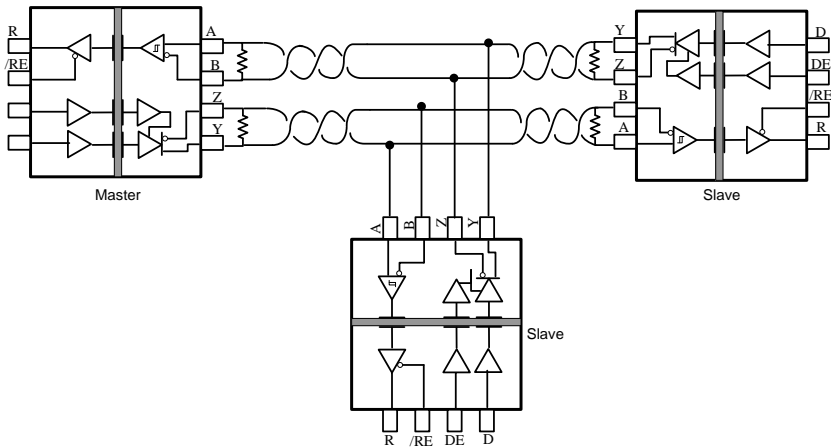


Figure 5.4 Typical isolated Full-Duplex RS-485 application

## 6.0 PACKAGE INFORMATION

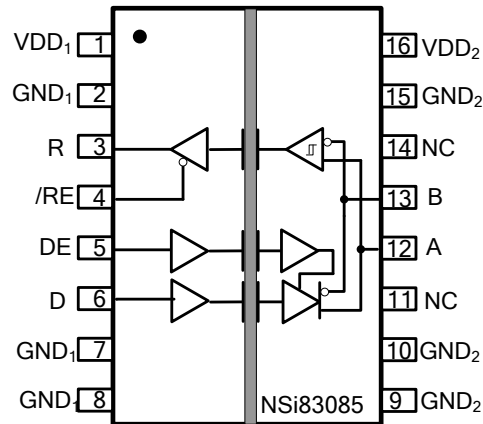


Figure 6.1 NSi83085A Package

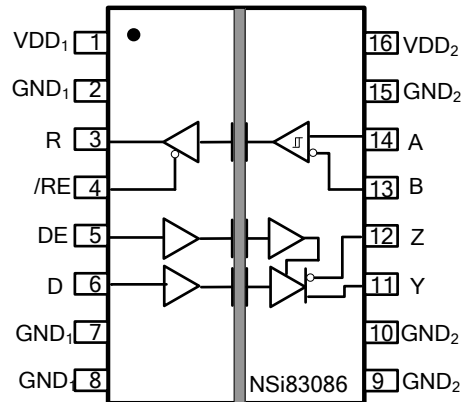


Figure 6.2 NSi83086A Package

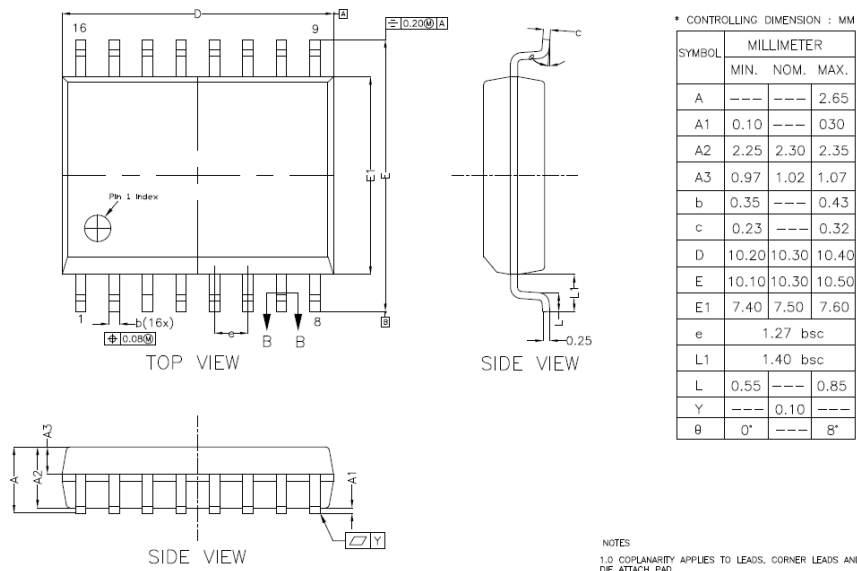


Figure 6.3 SOIC16 Package Shape and Dimension in millimeters and (inches)

Table6.1 NSi83085A Pin Configuration and Description

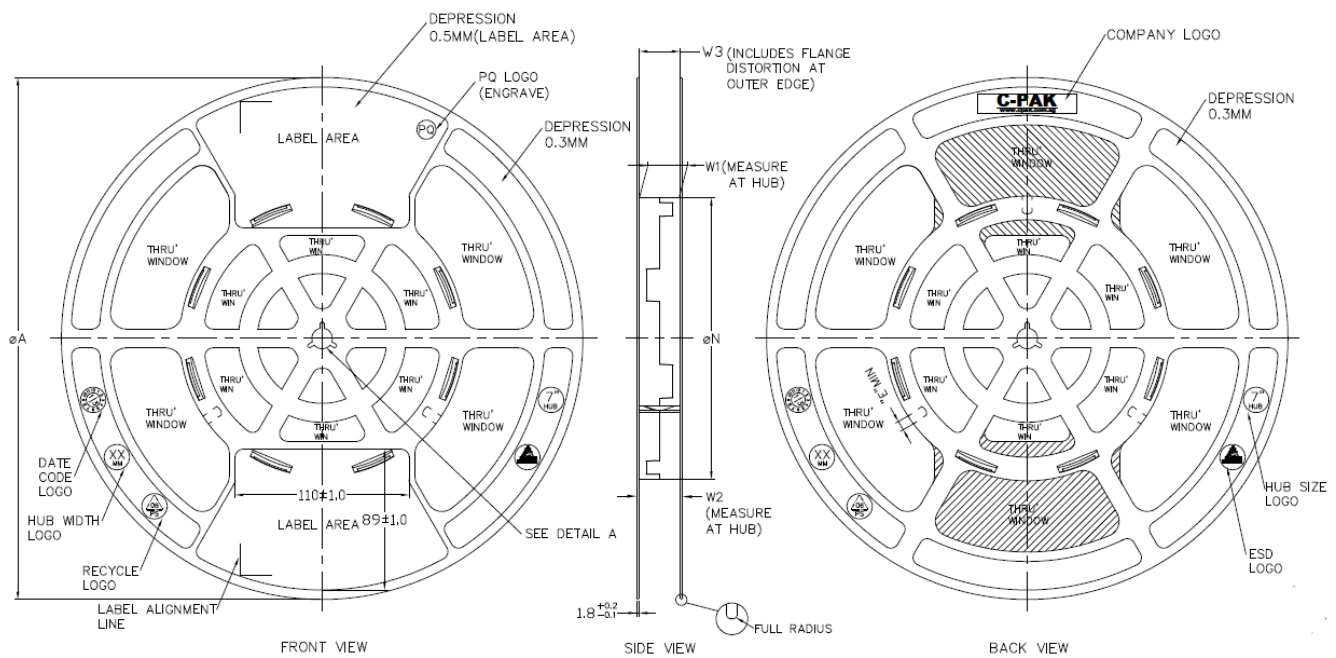
<i>NSi83085A PIN NO.</i>	<i>SYMBOL</i>	<i>FUNCTION</i>
1	VDD <sub>1</sub>	Power Supply for Isolator Side 1
2	GND <sub>1</sub>	Ground 1, the ground reference for Isolator Side 1
3	R	Receive output
4	/RE	Receive enable input. This is an active low input.
5	DE	Driver enable input. This is an active high input
6	D	Driver transmit data input.
7	GND <sub>1</sub>	Ground 1, the ground reference for Isolator Side 1
8	GND <sub>1</sub>	Ground 1, the ground reference for Isolator Side 1
9	GND <sub>2</sub>	Ground 2, the ground reference for Isolator Side 2
10	GND <sub>2</sub>	Ground 2, the ground reference for Isolator Side 2
11	NC	No Connection.
12	A	Noninverting Driver Output/Receiver Input. When the driver is disabled, or when VDD <sub>1</sub> or VDD <sub>2</sub> is powered down, Pin A is put into a high impedance state to avoid overloading the bus.
13	B	Inverting Driver Output/Receiver Input. When the driver is disabled, or when VDD <sub>1</sub> or VDD <sub>2</sub> is powered down, Pin B is put into a high impedance state to avoid overloading the bus.
14	NC	No Connection.
15	GND <sub>2</sub>	Ground 2, the ground reference for Isolator Side 2
16	VDD <sub>2</sub>	Power Supply for Isolator Side 2

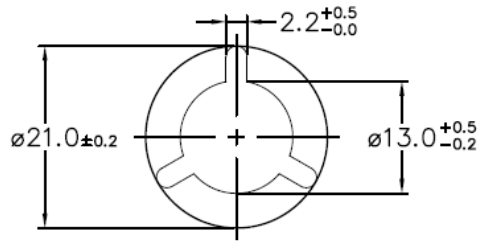
Table6.2 NSi83086A Pin Configuration and Description

<i>NSi83086A PIN NO.</i>	<i>SYMBOL</i>	<i>FUNCTION</i>
1	VDD <sub>1</sub>	Power Supply for Isolator Side 1
2	GND <sub>1</sub>	Ground 1, the ground reference for Isolator Side 1
3	R	Receive output
4	/RE	Receive enable input. This is an active low input.
5	DE	Driver enable input. This is an active high input

NSi83086A PIN NO.	SYMBOL	FUNCTION
6	D	Driver transmit data input.
7	GND <sub>1</sub>	Ground 1, the ground reference for Isolator Side 1
8	GND <sub>1</sub>	Ground 1, the ground reference for Isolator Side 1
9	GND <sub>2</sub>	Ground 2, the ground reference for Isolator Side 2
10	GND <sub>2</sub>	Ground 2, the ground reference for Isolator Side 2
11	Y	Noninverting Driver Output. When the driver is disabled, or when VDD <sub>1</sub> or VDD <sub>2</sub> is powered down, Pin Y is put into a high impedance state to avoid overloading the bus.
12	Z	Inverting Driver Output. When the driver is disabled, or when VDD <sub>1</sub> or VDD <sub>2</sub> is powered down, Pin Z is put into a high impedance state to avoid overloading the bus.
13	B	Inverting Receiver Input.
14	A	Noninverting Receiver Input.
15	GND <sub>2</sub>	Ground 2, the ground reference for Isolator Side 2
16	VDD <sub>2</sub>	Power Supply for Isolator Side 2

## 7.0 TAPE AND REEL INFORMATION

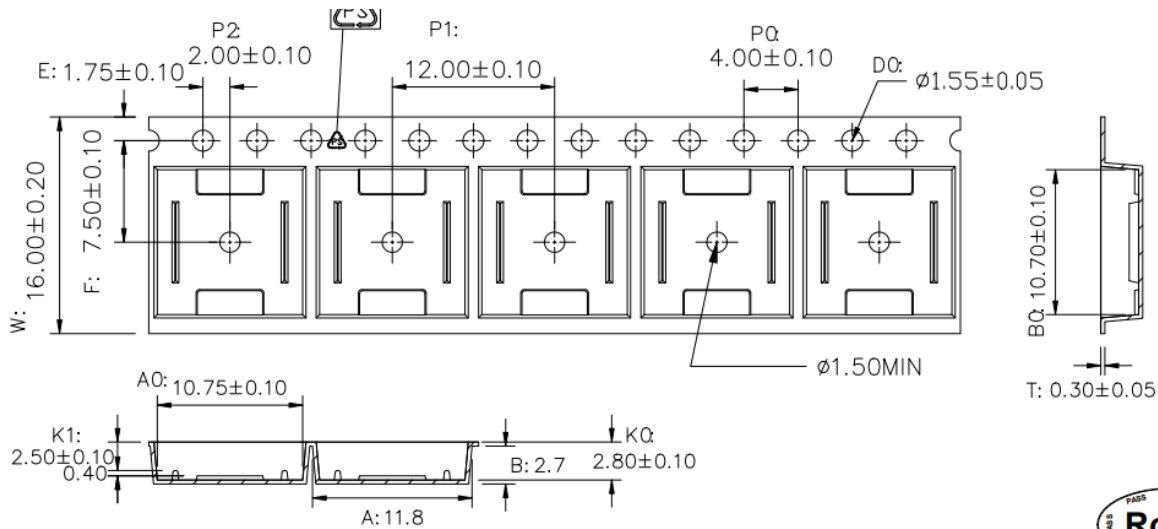




ARBOR HOLE  
DETAIL A  
SCALE : 3:1

PRODUCT SPECIFICATION						
TAPE WIDTH	ØA ±2.0	ØN ±2.0	W1	W2 (MAX)	W3	E (MIN)
08MM	330	178	8.4 <sup>+1.5</sup> <sub>-0.6</sub>	14.4	SHALL ACCOMMODATE TAPE WIDTH WITHOUT INTERFERENCE	5.5
12MM	330	178	12.4 <sup>+2.0</sup> <sub>-0.8</sub>	18.4		5.5
16MM	330	178	16.4 <sup>+2.0</sup> <sub>-0.8</sub>	22.4		5.5
24MM	330	178	24.4 <sup>+2.0</sup> <sub>-0.8</sub>	30.4		5.5
32MM	330	178	32.4 <sup>+2.0</sup> <sub>-0.8</sub>	38.4		5.5

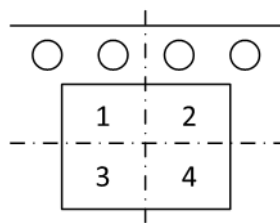
SURFACE RESISTIVITY			
LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW 10 <sup>12</sup>	ANTISTATIC	ALL TYPES
B	10 <sup>6</sup> TO 10 <sup>11</sup>	STATIC DISSIPATIVE	BLACK ONLY
C	10 <sup>5</sup> & BELOW 10 <sup>5</sup>	CONDUCTIVE (GENERIC)	BLACK ONLY
E	10 <sup>8</sup> TO 10 <sup>11</sup>	ANTISTATIC (COATED)	ALL TYPES



1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20$ .
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 :  $0.30 \pm 0.05$ mm.
6. Packing length per 22" reel : 378 Meters.(復卷 N=122)
7. Component load per 13" reel : 1000 pcs.
8. Surface resistivity :  $10^5 \sim 10^{10} \Omega/\square$



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



Quadrant  
Designations

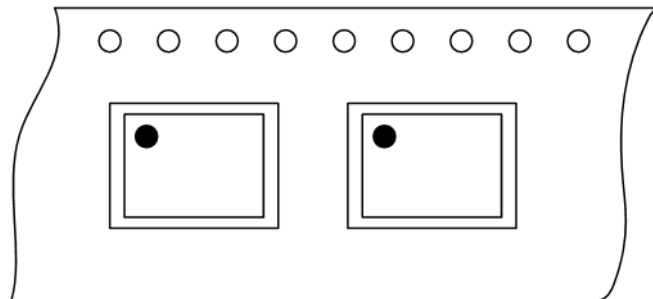


Figure 7.1 Tape and Reel Information of SOW16

## 8.0 ORDER INFORMATION

---

<i>Part No.</i>	<i>Isolation Rating(kV<sub>RMS</sub>)</i>	<i>Duplex</i>	<i>Max Data Rate (Mbps)</i>	<i>MSL</i>	<i>Temperature</i>	<i>No. of Nodes</i>	<i>Package</i>	<i>SPQ</i>
NSi83085A	5	Half	0.5	2	-40 to 105°C	256	SOW16	1000
NSi83086A	5	Full	16	2	-40 to 105°C	256	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.								

## 9.0 REVISION HISTORY

---

<b>Revision</b>	<b>Description</b>	<b>Date</b>
1.0	Initial version	2021/2/4