NSIP93086

Signal Isolated RS-485 Transceiver With Integrated DC to DC Converter

Preliminary Datasheet (EN) 0.0

Subject to change without notice

Product Overview

NSIP93086 series are high reliability isolated full duplex RS-485 transceiver with integrated DC to DC converter. The NSIP93086 isolated DC to DC converter uses on-chip transformer. The feedback PWM signal is sent to primary side(Isolator Side1) by a digital isolator based on Novosense capacity isolation technology. The NSIP93086 series are safety certified by UL1577 supporting 5kVrms insulation withstand voltage, while the high integrated solution can help to simplify system design and improve reliability.

The Bus pins of NSIP93086 are protected from ±8kV system level ESD to GND_2. The device features a fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. The device have 96kΩ input impedance that allows up to 256 transceivers on the bus.

Key Features

- Up to 5000Vrms Insulation voltage
- ISO-Power integrated isolated DC-to-DC converter
- I/O voltage range supports 1.8~5.25V MCU
- Power supply voltage:
  - VDD: 3V to 5.25V
  - VDDL:1.8V to 5.25V
- Voltage conversion: 5V to 5V, 5V to 3.3V, 3.3V to 3.3V.
- Over current and over temperature protection
- High CMTI: ±150kV/us
- Data rate: 16Mbps
- Up to 256 transceivers on the bus
- High system level EMC performance:
- Operation temperature: -40℃~125℃
- RoHS-compliant packages: SOW16 SOW20

Safety Regulatory Approvals

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

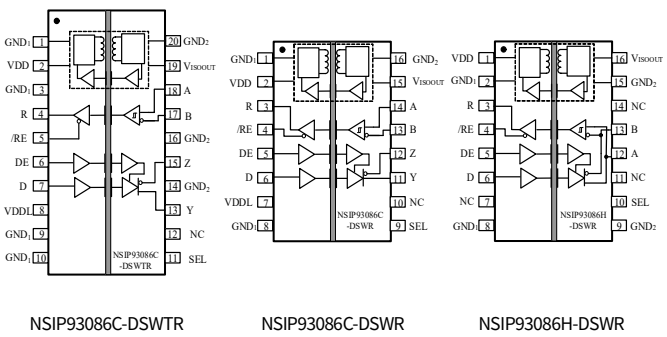
Applications

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

Device Information

Part Number	*Package*	*Body Size*
NSIP93086C-DSWTR	SOW20	12.80mm × 7.50mm
NSIP93086C-DSWR	SOW16	10.30mm x 7.50mm
NSIP93086H-DSWR	SOW16	10.30mm x 7.50mm

Functional Block Diagrams



NSIP93086C-DSWTR NSIP93086C-DSWR NSIP93086H-DSWR

Figure 1. NSIP93086 Block Diagrams

INDEX

1. Pin Configuration and Functions

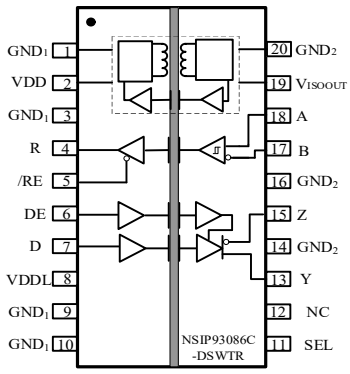


Figure 1.1 NSIP93086C-DSWTR Package

Table1.1NSIP93086V-DSWR Pin Configuration and Description

PIN NO.	SYMBOL	FUNCTION
1	GND_1	Ground 1, the ground reference for Isolator Side 1
2	V_{DD}	Power Supply for Isolator Side 1. It is recommended this pin have a 0.1 µF + 10 µF capacitor to GND_1 (Pin1)
3	GND_1	Ground 1, the ground reference for Isolator Side 1
4	R	Receiver output
5	/RE	Receiver enable input, this is an active low input
6	DE	Driver enable input, this is an active high input
7	D	Driver transmit data input
8	VDDL	Side1 I/O logic level
9	GND_1	Ground 1, the ground reference for Isolator Side 1
10	GND_2	Ground 2, the ground reference for Isolator Side 2
11	SEL	VISO output voltage select, VISO=5V when SEL short to VISO, VISO=3.3V when SEL short to GND_2 or floating.
12	NC	Not Connected
13	Y	Non-inverting Driver Output. When the driver is disabled, or when VDD is powered down, Pin Y is put into a high impedance state to avoid overloading the bus.
14	GND_2	Ground 2, the ground reference for Isolator Side 2.
15	Z	Inverting Driver Output. When the driver is disabled, or when VDD is powered down, Pin Z is put into a high impedance state to avoid overloading the bus.
16	GND_2	Ground 2, the ground reference for Isolator Side 2.

17	B	Inverting Receiver Input
18	A	Non-inverting Receiver Input
19	V_{ISOOUT}	Isolated Power Supply Output. It is recommended this pin have a 0.1 μF and 10μF capacitor to GND_2 (Pin16).
20	GND_2	Ground 2, the ground reference for Isolator Side 2.

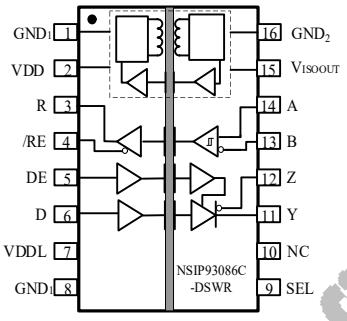


Figure 1.2 NSIP93086C-DSWR Package

Table1.2 NSIP93086C-DSWR Pin Configuration and Description

PIN NO.	SYMBOL	FUNCTION
1	GND_1	Ground 1, the ground reference for Isolator Side 1
2	V_{DD}	Power Supply for Isolator Side 1. It is recommended this pin have a 0.1 μF + 10 μF capacitor to GND_1 (Pin1)
3	R	Receiver output
4	/RE	Receiver 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	V_{DDL}	Side1 I/O logic level
8	GND_1	Ground 1, the ground reference for Isolator Side 1
9	SEL	VISO output voltage select, VISO=5V when SEL short to VISO, VISO=3.3V when SEL short to GND_2 or floating.
10	NC	Not Connected
11	Y	Non-inverting Driver Output. When the driver is disabled, or when VDD 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 is powered down, Pin Z is put into a high impedance state to avoid overloading the bus.
13	B	Inverting Receiver Input
14	A	Non-inverting Receiver Input

15	V_{ISOOUT}	Isolated Power Supply Output. It is recommended this pin have a 0.1 μF and 10μF capacitor to GND_2 (Pin16).
16	GND_2	Ground 2, the ground reference for Isolator Side 2.

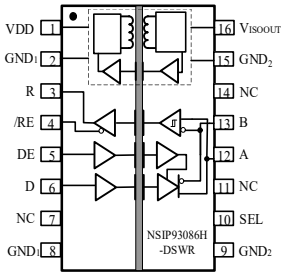


Figure 1.3 NSIP93086H-DSWR Package

Table1.3 NSIP93086C-DSWR Pin Configuration and Description

PIN NO.	SYMBOL	FUNCTION
1	V_{DD}	Power Supply for Isolator Side 1. It is recommended this pin have a 0.1 μF + 10 μF capacitor to GND_1 (Pin1)
2	GND_1	Ground 1, the ground reference for Isolator Side 1
3	R	Receiver output
4	/RE	Receiver 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	NC	Not Connected
8	GND_1	Ground 1, the ground reference for Isolator Side 1
9	GND_2	Ground 2, the ground reference for Isolator Side 2.
10	SEL	VISO output voltage select, VISO=5V when SEL short to VISO, VISO=3.3V when SEL short to GND_2 or floating.
11	NC	Not Connected
12	A	Non-inverting Driver Output/Receiver Input. When the driver is disabled, or when VDD is powered down, Pin Y 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 is powered down, Pin Z is put into a high impedance state to avoid overloading the bus.
14	NC	Not Connected
15	GND_2	Ground 2, the ground reference for Isolator Side 2.
16	V_{ISOOUT}	Isolated Power Supply Output. It is recommended this pin have a 0.1 μF and 10μF capacitor to GND_2 (Pin16).

2. Absolute Maximum Ratings

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	V_{DD}	-0.5		6	V	
Side1 I/O logic level	V_{DDL}	-0.5		6	V	
Maximum Input Voltage	/RE, DE, D	-0.4		V_{DDL}[1]+0.4	V	
Driver Output/Receiver Input Voltage	V_A, V_B, V_Y, V_Z	-7		12	V	
Differential input voltage, A with repect to B	V_{ID}	-18		18	V	
R output current	I_O	-15		15	mA	
Operating Temperature	T_{OPR}	-40		125	℃	
Storage Temperature	T_{STG}	-40		150	℃	

[1]For NSIP93086H-DSWR, V_{DD} replaces V_{DDL}.

3. ESD Ratings

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

4. Recommended Operating Conditions

Parameters	Symbol	Min	Typ	Max	Unit
NSIP93086C/H Power Supply Voltage	V_{DD}	3	3.3/5	5.25	V
NSIP93086C Side1 I/O logic level	V_{DDL}	1.8		5.25	V
Side1 High Level Input Voltage	V_{IH}	0.7*V_{DDL}[1]		V_{DDL}	V
Side1 Low Level Input Voltage	V_{IL}	0		0.3*V_{DDL}	V
Data rate	DR			16	Mbps
Voltage at any bus terminal (separately or common mode)	V_I	-7		12	V
Differential input voltage	V_{ID}	-12		12	V
Ambient Temperature	T_a	-40		125	℃

[1]For NSIP93086H-DSWR, V_{DD} replaces V_{DDL}.

5. Thermal Information

Parameters	Symbol	SOW16	Unit
IC Junction-to-Air Thermal Resistance	θ_{JA}	59.2	°C/W
Junction-to-top characterization parameter	ψ_{JT}	8.7	°C/W
Junction-to-board characterization parameter	ψ_{JB}	23	°C/W

6. Specifications

6.1. DC Electrical Characteristics

(VDD=3V~5.25V, VDDL=VDD, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at VDD =5V,V_{ISOOUT}=3.3V, Ta = 25℃)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power supply voltage NSIP93086VN	V_{DD}	3		5.25	V	
Supply current 3V≤V_{DD}≤3.6 V V_{ISOOUT} = 3.3V	I_{DD} (500kbps)		54	79	mA	R_L=120 Ω
			80	110	mA	R_L=54 Ω
	I_{DD} (16Mbps)		77	106	mA	R_L=120 Ω
			94	127	mA	R_L=54 Ω
Supply current 4.75V≤V_{DD}≤5.25 V V_{ISOOUT} = 3.3V	I_{DD} (500kbps)		49	72	mA	R_L=120 Ω
			70	98	mA	R_L=54 Ω
	I_{DD} (16Mbps)		69	98	mA	R_L=120 Ω
			81	112	mA	R_L=54 Ω
Isolated supply voltage	V_{ISOOUT}		3.3		V	
Thermal-Shutdown Threshold	T_{TS}		165		℃	
Thermal-Shutdown Hysteresis	T_{TSH}		15		℃	
Common Mode Transient Immunity	CMTI	100	150		kV/us	Figure 6.12
Side1						
Input High Voltage	V_{IH}	0.7*V_{DDL}[1]			V	DE, D, /RE
Input Low Voltage	V_{IL}			0.3*V_{DDL}	V	DE, D, /RE
Input Current	I_I	-20		20	uA	D, DE, /RE
Output Voltage High	V_{OH}	V_{DDL}-0.4			V	I_{OH} = -4mA
Output Voltage Low	V_{OL}			0.4	V	I_{OL} = 4mA

Output Short-Circuit Current	I_{OSR}	-200		200	mA	$0 \le V_R \le VDD$
Input Capacitance	C_{IN}		2		pF	DE, D, /RE
Driver						
Differential Output Voltage	$\lvert V_{OD} \rvert$			3.3	V	No Load， V_{ISOOUT}=3.3V
		1.8	2.5		V	Figure 6.7,R_L=120Ω, V_{Isoout}=3.3V
		1.5	2		V	Figure 6.7,R_L=54Ω, V_{Isoout}=3.3V

[1]For NSIP93086H-DSWR, V_{DD} replaces V_{DDL}.

Change in differential output voltage between the two states	$\Delta\lvert V_{OD} \rvert$	-0.2		0.2	V	Figure 6.7, R_L=120Ω or R_L=54Ω
Common-Mode Output Voltage	$\lvert V_{OC} \rvert$	1	1.65	3	V	Figure 6.7, R_L=120Ω or R_L =54Ω
Change in steady-state common-mode output voltage between the two state	$\Delta\lvert V_{OC} \rvert$	-0.2		0.2	V	Figure 6.7, R_L=120Ω or R_L =54Ω
Peak-to-peak driver common-mode output voltage	$V_{OC(PP)}$		450		mV	Figure 6.13
Driver Short-Circuit Output Current	I_{OSD}	-200		200	mA	$-7V \le V_{Test} \le 12$ V
Receiver						
Input Current (A and B)	I_A, I_B			200	uA	DE=0V, V_{Test}=12V
		-200			uA	DE=0V, V_{Test}=-7V
Receiver Differential Threshold Voltage	V_{TH}	-210	-125	-10	mV	DE=/RE=Low
Receiver Input Hysteresis	ΔV_{TH}		30		mV	V_{CM}=0V
Receiver Input Resistance	R_{IN}	96			kΩ	$-7V \le V_{CM} \le 12V$, DE=0V

6.2. Switching Electrical Characteristics

(VDD=3V~5.25V, VDDL=VDD, Ta=-40℃ to 125℃. Unless otherwise noted, Typical values are at VDD =5V,V_{ISOOUT}=3.3V, Ta = 25℃)

Parameters	*Symbol*	*Min*	*Typ*	*Max*	*Unit*	*Comments*
Driver						
Maximum Data Rate	f_{MAX}			16	Mbps	
Driver Propagation Delay	t_{PLH}		33	60	ns	Figure 6.8， R_L=54Ω， C_L=50pF

	t_{PHL}		28	55	ns	Figure 6.8, R_L=54Ω, C_L=50pF
Driver Pulse Width Distortion, $\|t_{PHL} - t_{PLH}\|$	t_{skew}		5	25	ns	Figure 6.8, R_L=54Ω, C_L=50pF
Driver Output Falling Time or Rising time	t_F			15	ns	Figure 6.8, R_L=54Ω, C_L=50pF
	t_R			15	ns	Figure 6.8, R_L=54Ω, C_L=50pF
Driver Enable to Output High	t_{ZH}		45	75	ns	Figure 6.9, R_L=120Ω, C_L=50pF
Driver Enable to Output Low	t_{ZL}		45	75	ns	Figure 6.9, R_L=120Ω, C_L=50pF
Driver Disable to Output High	t_{HZ}		12	40	ns	Figure 6.9, R_L=120Ω, C_L=50pF
Driver Disable to Output Low	t_{LZ}		12	40	ns	Figure 6.9, R_L=120Ω, C_L=50pF
Receiver						
Maximum Data Rate	f_{MAX}	16			Mbps	
Receiver Propagation Delay	t_{PLH}		45	75	ns	Figure 6.10, C_L=15pF
	t_{PHL}		46	95	ns	Figure 6.10, C_L=15pF
Receiver Pulse Width Distortion, $\|t_{PHL} - t_{PLH}\|$	t_{skew}		2	55	ns	Figure 6.10, C_L=15pF
Receiver Output Falling Time or Rising time	t_F			15	ns	Figure 6.10, C_L=15pF
	t_R			15	ns	Figure 6.10, C_L=15pF
Receiver Enable to Output High	t_{ZH}		45	60	ns	Figure 6.11, R_L=1kΩ, C_L=15pF
Receiver Enable to Output Low	t_{ZL}		45	60	ns	Figure 6.11, R_L=1kΩ, C_L=15pF
Receiver Disable to Output High	t_{HZ}		33	60	ns	Figure 6.11, R_L=1kΩ, C_L=15pF
Receiver Disable to Output Low	t_{LZ}		33	60	ns	Figure 6.11, R_L=1kΩ, C_L=15pF

6.3. Typical Performance Characteristics

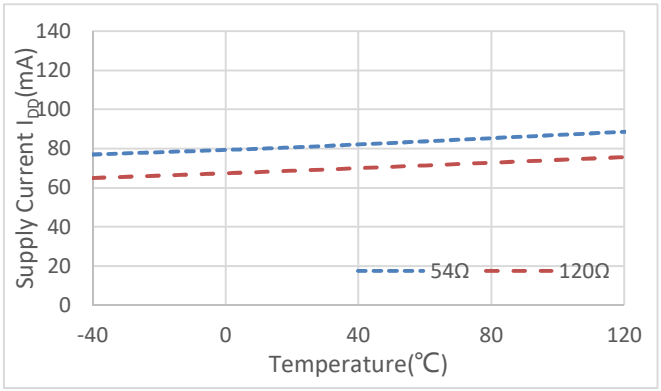


Figure 6.1 supply current vs Temperature
(Data Rate=16MHz,DE=V_{DDL},/RE=GND,VDD=5V,V_{ISOOUT}=3.3V)

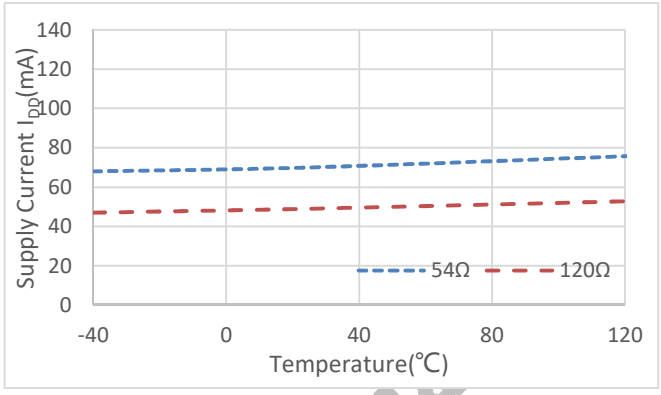


Figure 6.2 supply current vs Temperature
(Data Rate=500KHz,DE=V_{DDL},/RE=GND,VDD=5V,V_{ISOOUT}=3.3V)

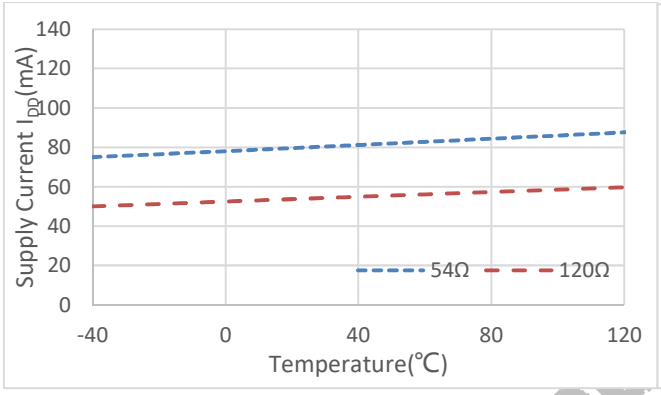


Figure 6.3 supply current vs Temperature
(Data Rate=16MHz,DE=V_{DDL},/RE=GND,VDD=3.3V,V_{ISOOUT}=3.3V)

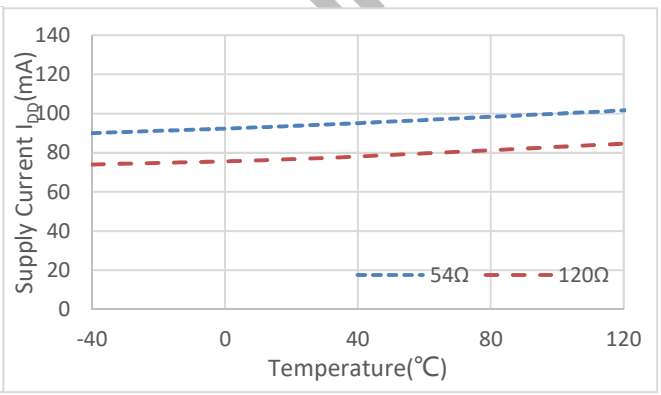


Figure 6.4 supply current vs Temperature
(Data Rate=500KHz,DE=V_{DDL},/RE=GND,VDD=3.3V,V_{ISOOUT}=3.3V)

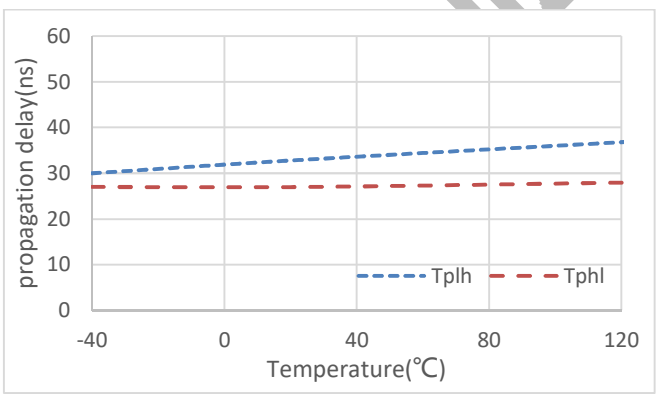


Figure 6.5 Driver Propagation Delay vs Temperature

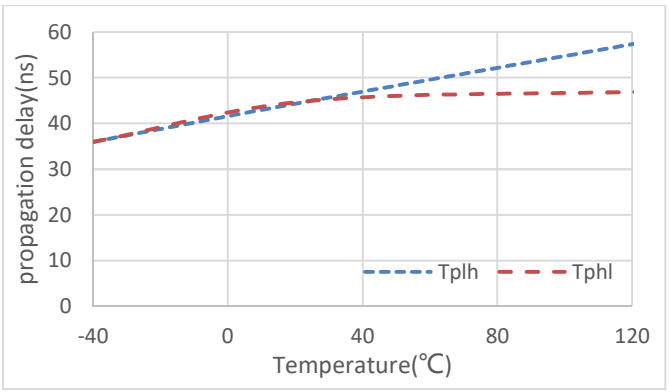


Figure 6.6 Receiver Propagation Delay vs Temperature

6.4. Parameter Measurement Information

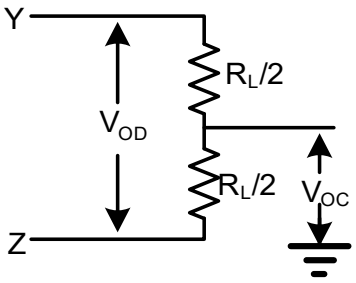


Figure 6.7 Driver DC Test Load

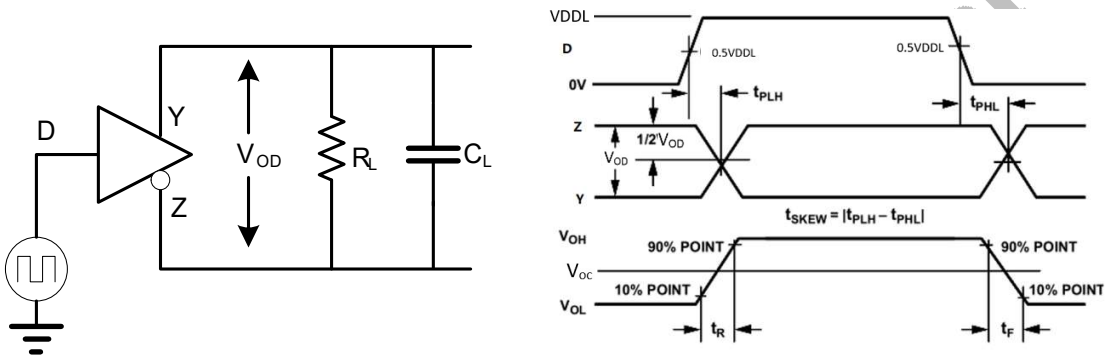


Figure 6.8 Driver Timing Test Circuit and waveform

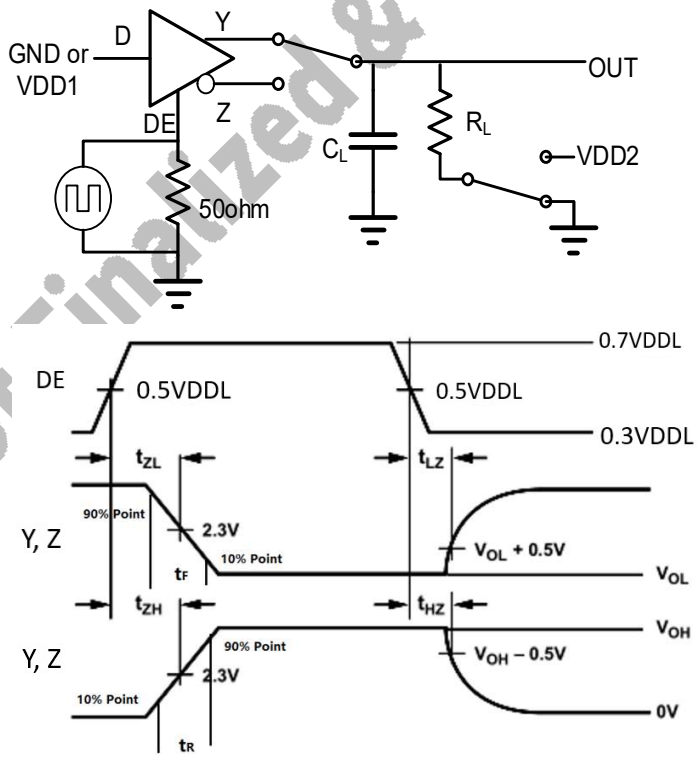


Figure 6.9 Driver Enable Disable Timing Test Circuit and waveform

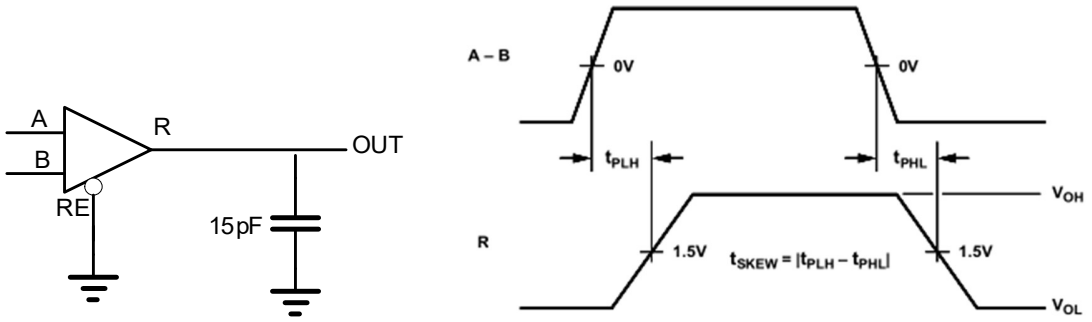


Figure 6.10 Receiver Propagation Delay Test Circuit and waveform

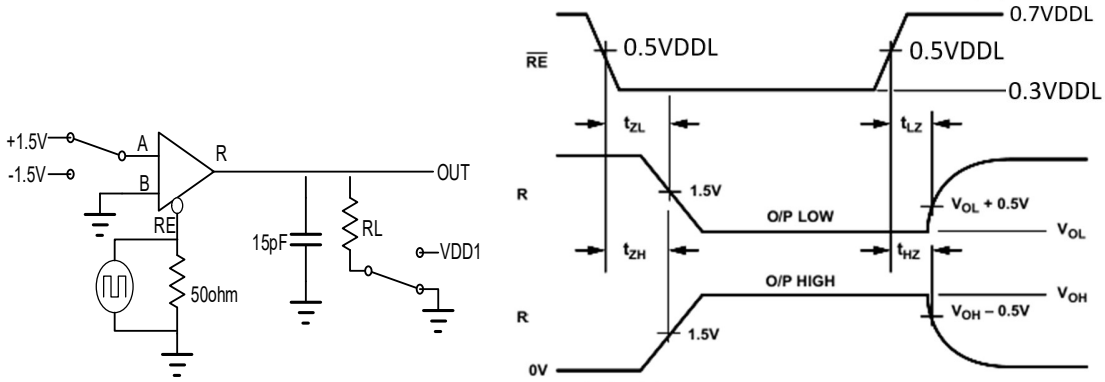


Figure 6.11 Receiver Enable Disable Timing Test Circuit and waveform

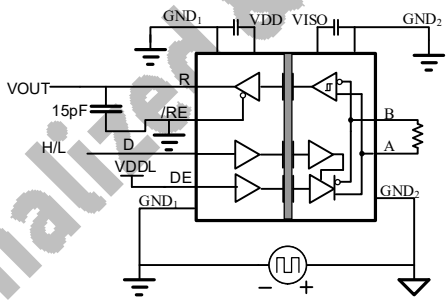


Figure 6.12 Common-Mode Transient Immunity Test Circuit

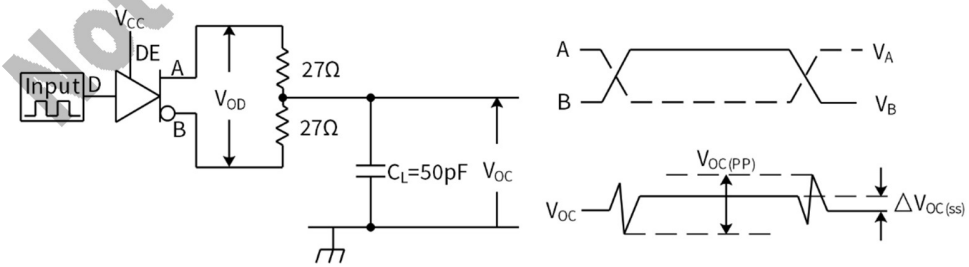


Figure 6.13 Measurement of Driver Common-Mode Output Voltage With RS-485 Load

7. High Voltage Feature Description

7.1. Insulation and Safety Related Specifications

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

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

7.2. Insulation Characteristics

Description	*Test Condition*	*Symbol*	*Value*	*Unit*
Maximum repetitive isolation voltage		V_{IORM}	1500	V_{PEAK}
Maximum working isolation voltage	AC Voltage	V_{IOWM}	1061	V_{RMS}
	DC Voltage		1500	V_{DC}
Apparent Charge	Method a, after Input/output safety test subgroup 2/3, Vini=V_{IOTM}, t_{ini} = 60 s , $V_{pd(m)}$=1.2*V_{IORM}, t_m=10s.	q_{pd}	<5	pC
	Method a, after environmental tests			pC

Description	Test Condition	Symbol	Value	Unit
	subgroup 1, Vini=V_{IOTM}, t_{ini}=60s ,$V_{pd(m)}$=1.6*V_{IORM}, t_m=10s			
	Method b, routine test (100% production) and preconditioning (type test);V_{ini}=1.2*V_{IOTM}, t_{ini}=1s $V_{pd(m)}$=1.875*V_{IORM}, t_m=1s （method b1） or $V_{pd(m)}$=Vini, t_m=t_{ini}(method b2)			pC
Maximum transient isolation voltage	t = 60 sec	V_{IOTM}	7070	V_{PEAK}
Maximum impulse voltage	Tested in air, 1.2/50-us waveform per IEC62368-1	V_{IMP}	7600	V_{PEAK}
Maximum Surge Isolation Voltage	Test method per IEC62368-1, 1.2/50us waveform, V_{IOSM}≥V_{IMP} × 1.3	V_{IOSM}	10000	V_{PEAK}
Isolation resistance	V_{IO} =500V, T_{amb}=25℃	R_{IO}	>10^{12}	Ω
	V_{IO} =500V, 100℃ ≤ T_{amb} ≤ 125℃	R_{IO}	>10^{11}	Ω
	V_{IO} =500V, T_{amb}=T_s	R_{IO}	>10^{9}	Ω
Isolation capacitance	f = 1MHz	C_{IO}	0.8	pF
Safety total power dissipation	θ_{JA} = 59.2 °C/W, V_I = 5.25V, T_J = 150 ℃, T_A = 25 ℃	Ps	2111	mW
Safety input, output, or supply current	θ_{JA} = 59.2 °C/W, V_I = 5.25 V, T_J = 150 °C, T_A = 25 °C	Is	402	mA
Maximum safety temperature		Ts	150	℃
UL1577				
Insulation voltage per UL	V_{TEST} = V_{ISO}, t = 60 s (qualification), V_{TEST} = 1.2 × V_{ISO}, t = 1 s (100% production test)	V_{ISO}	5000	V_{RMS}

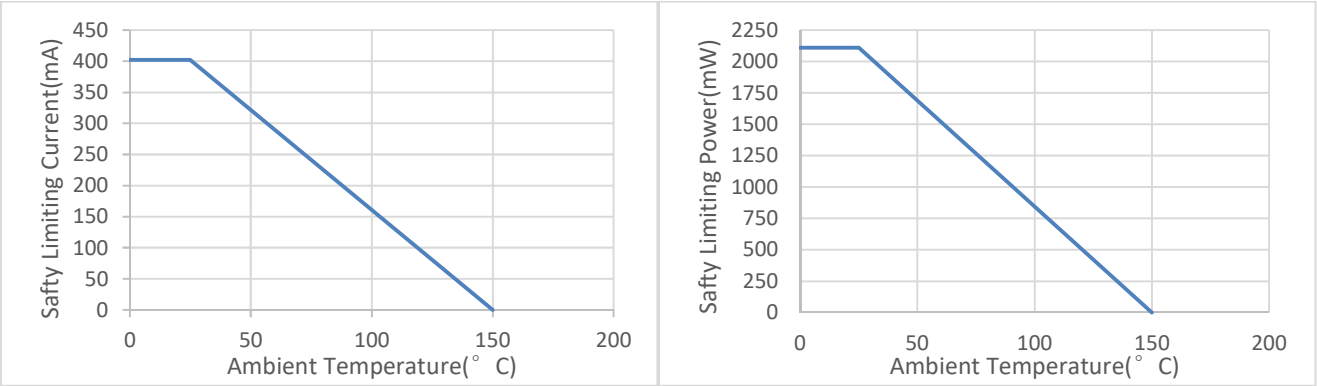


Figure 7.1 NSIP93086 Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-17

7.3. Regulatory Information

The NSIP954x are approved or pending approval by the organizations listed in table.

UL		*VDE*	*CQC*
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	Certified according to DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to GB4943.1
Single Protection, 5000V_{rms} Isolation voltage	Single Protection, 5000V_{rms} Isolation voltage	Reinforced Insulation V_{IORM}=1500Vpeak V_{IOTM}=7070Vpeak V_{IOSM}=10000Vpeak	Reinforced insulation
E500602	E500602	40057024	CQC20001264939

8. Function Description

NSIP93086 is a high reliability 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. The 93086 series are safety certified by UL1577 supporting 5kV$_{RMS}$ insulation withstand voltage.

8.1. 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 -10mV and -200mV, which meets EIA/TIA-485 standard. If the differential input voltage (V_A-V_B) is greater than or equal to -10mV, 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.

8.2. Truth Tables

Table 7.1 Driver Function Table[1]

VDD status	*Input (D)*	*Enable Input (DE)*	*Outputs Y*	*Z*
PU	H	H	H	L
PU	L	H	L	H
PU	X	L	Z	Z
PU	X	OPEN	Z	Z
PU	OPEN	H	H	L
PD	X	X	Z	Z

Table 7.2 Receiver Function Table[1]

VDD status	*Differential Input (VA-VB)*	*Enable Input (/RE)*	*Output (R)*
PU	≥-10mV	L/Open	H
PU	≤-200mV	L/Open	L
PU	Open/Short	L/Open	H
PU	X	H	H
PU	Idle	L	H
PD	X	X	Z

[1] PD= Powered down; PU= Powered up; H= Logic High; L= Logic Low; X= Irrelevant; Z= High Impedance;

8.3. EMI Considerations

NSIP93086 use a small on-chip transformer to provide power for RS485 Transceiver. The on-chip transformer operates at high frequency, which may degrade EMI performance, to achieve better EMI performance, special considerations must be taken during PCB layout. Please refer to the application note if needed.

8.4. Output Short and Over Temperature Protection

The NSIP93086 series are protected against output short for V_{ISOOUT}. When short on V_{ISOOUT} occurs, the device will be in Hiccup mode and the power transferred will be limit, which will limit the temperature of the device to protect the device.

The NSIP93086 series also protected against over temperature. When the chip is over 165℃, it will be shut down until the temperature of below 145℃.

9. Application Note

9.1. 256 Transceivers on the Bus

The devices have a 1/8-unit-load receiver input impedance (96kΩ) 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.

9.2. ESD Protection

ESD protection structures are enhanced on all pins to protect against electrostatic discharge encountered during handing and assembly. The Bus pins have extra protection against static electricity to bus side (V_{ISOOUT} side).

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

Bus pins:

- ±8kV w.r.t to GND2 using the Contact Discharge method specified in IEC 61000-4-2

9.3. Layout Considerations

The NSIP93086 requires a 10μF+0.1μF bypass capacitor between VDD_1 and GND_1, 10uF+0.1uF bypass capacitor between V_{ISOOUT} and GND_2. The capacitor should be placed as close as possible to the package. To eliminate line reflections, each cable end (A-B, Y-Z) is terminated with a resistor, whose value matches the characteristic impedance of the cable(54Ω/120Ω). It's good practice to place the bus connectors and termination resistor as close as possible to the A and B, Y and Z pins.

9.4. Typical Application

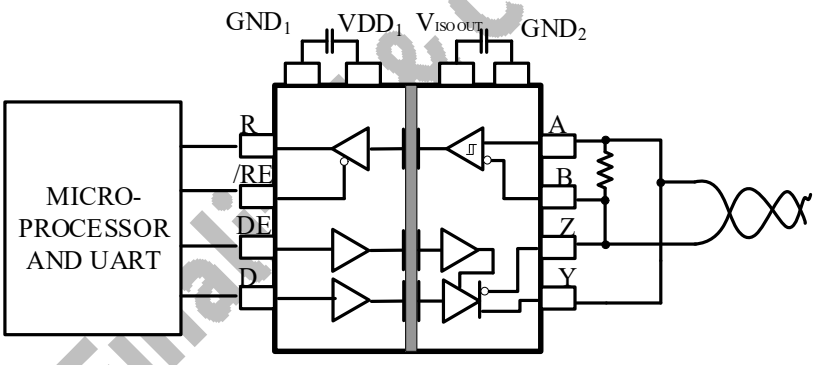


Figure 9.1 NSIP93086 in Half-Duplex RS-485 Mode

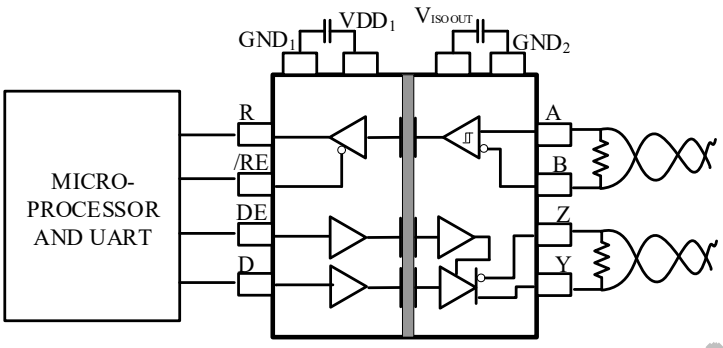


Figure 9.2 NSIP93086 typical application circuit

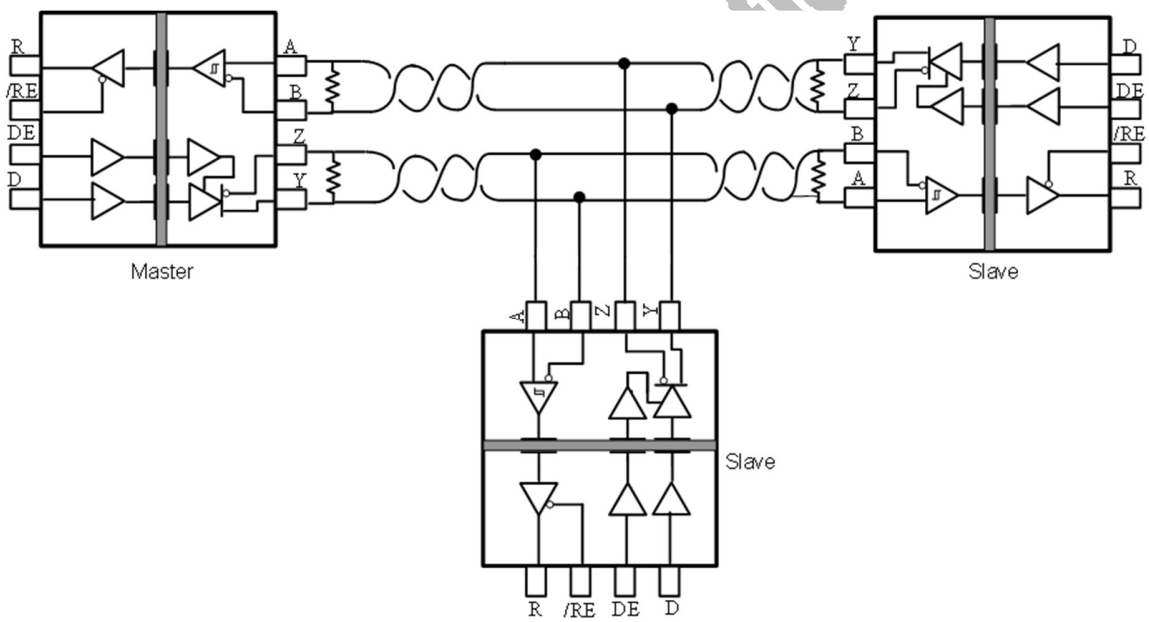
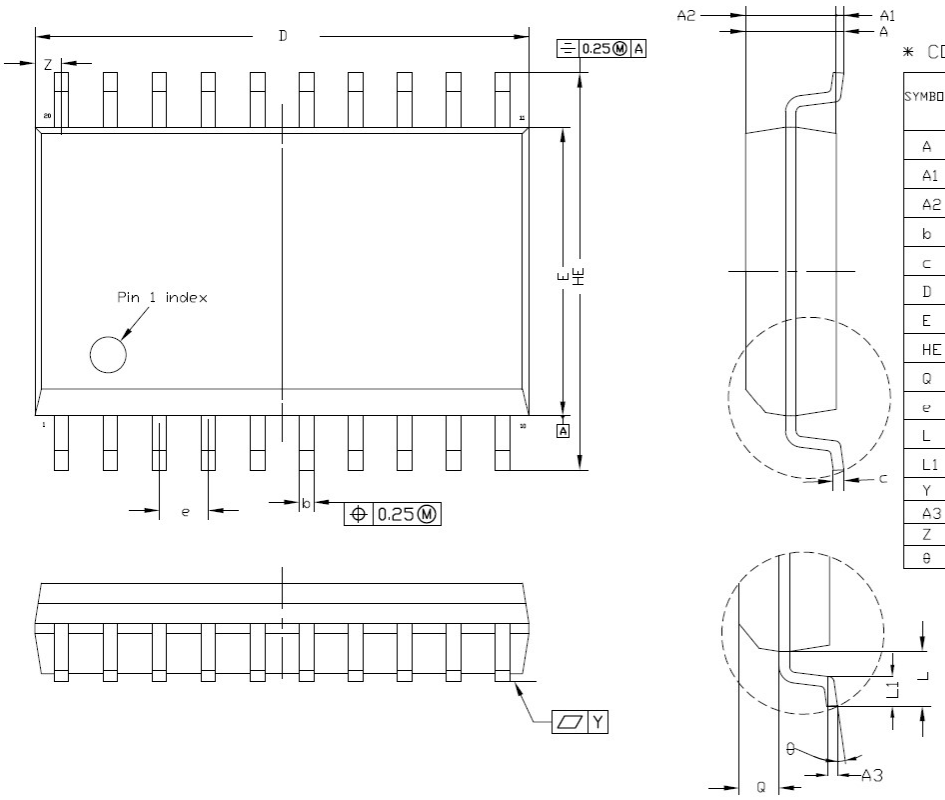


Figure 9.3 Typical isolated Full-Duplex RS-485 application

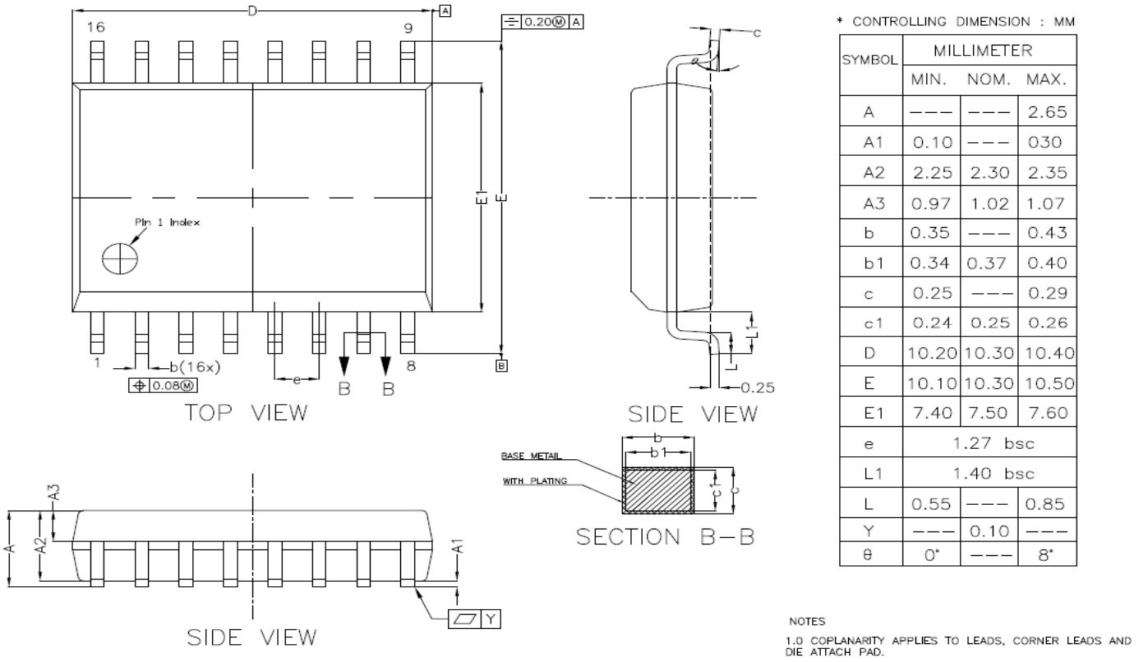
10. Package Information



* CONTROLLING DIMENSION : MM

SYMBOL	MILLIMETER			INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	---	---	2.65	---	---	0.100
A1	0.10	---	0.30	0.004	---	0.012
A2	2.25	---	2.45	0.089	---	0.096
b	0.36	---	0.49	0.014	---	0.019
c	0.23	---	0.32	0.009	---	0.013
D	12.6	---	13.0	0.49	---	0.51
E	7.4	---	7.6	0.29	---	0.30
HE	10.00	---	10.65	0.394	---	0.419
Q	1.0	---	1.1	0.039	---	0.043
e	1.27 bsc			0.050 bsc		
L	1.40 bsc			0.055 bsc		
L1	0.40	---	1.10	0.016	---	0.043
Y	---	0.10	---	---	0.004	---
A3	---	0.25	---	---	0.010	---
Z	0.40		0.90	0.016		0.035
θ	0°	---	8°	0°	---	8°

Figure 10.1 SOW20 Package Shape and Dimension in millimeters



* CONTROLLING DIMENSION : MM

SYMBOL	MILLIMETER		
	MIN.	NOM.	MAX.
A	---	---	2.65
A1	0.10	---	030
A2	2.25	2.30	2.35
A3	0.97	1.02	1.07
b	0.35	---	0.43
b1	0.34	0.37	0.40
c	0.25	---	0.29
c1	0.24	0.25	0.26
D	10.20	10.30	10.40
E	10.10	10.30	10.50
E1	7.40	7.50	7.60
e	1.27 bsc		
L1	1.40 bsc		
L	0.55	---	0.85
Y	---	0.10	---
θ	0°	---	8°

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

Figure 10.2 SOW16 Package Shape and Dimension in millimeters

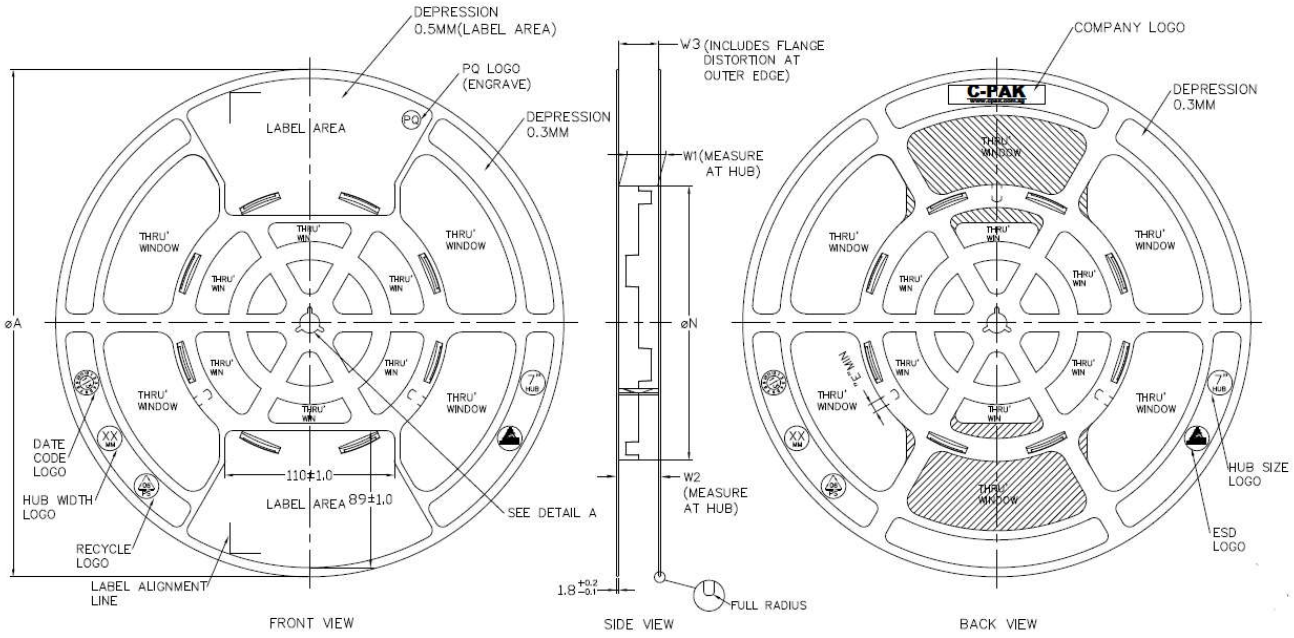
11. Ordering Information

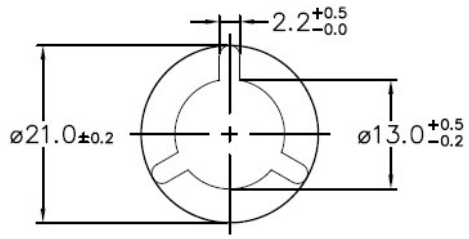
Part Number	Isolation Rating (kV_{RMS})	V_{ISOOUT}	Duplex	Max Data Rate (Mbps)	MSL	Temperature	No. of Nodes	Package Type	Package Drawing	SPQ
NSIP93086C-DSWTR	5	5/3.3V	Full	16	3	-40 to 125℃	256	SOP16(300mil)	SOW20	1000
NSIP93086C-DSWR	5	5/3.3V	Full	16	3	-40 to 125℃	256	SOP16(300mil)	SOW16	1000
NSIP93086H-DSWR	5	5/3.3V	Half	16	3	-40 to 125℃	256	SOP16(300mil)	SOW16	1000

12. Documentation Support

Part Number	Product Folder	Datasheet	Application Note
NSIP93086	tbd	tbd	tbd

13. Tape And Reel Information

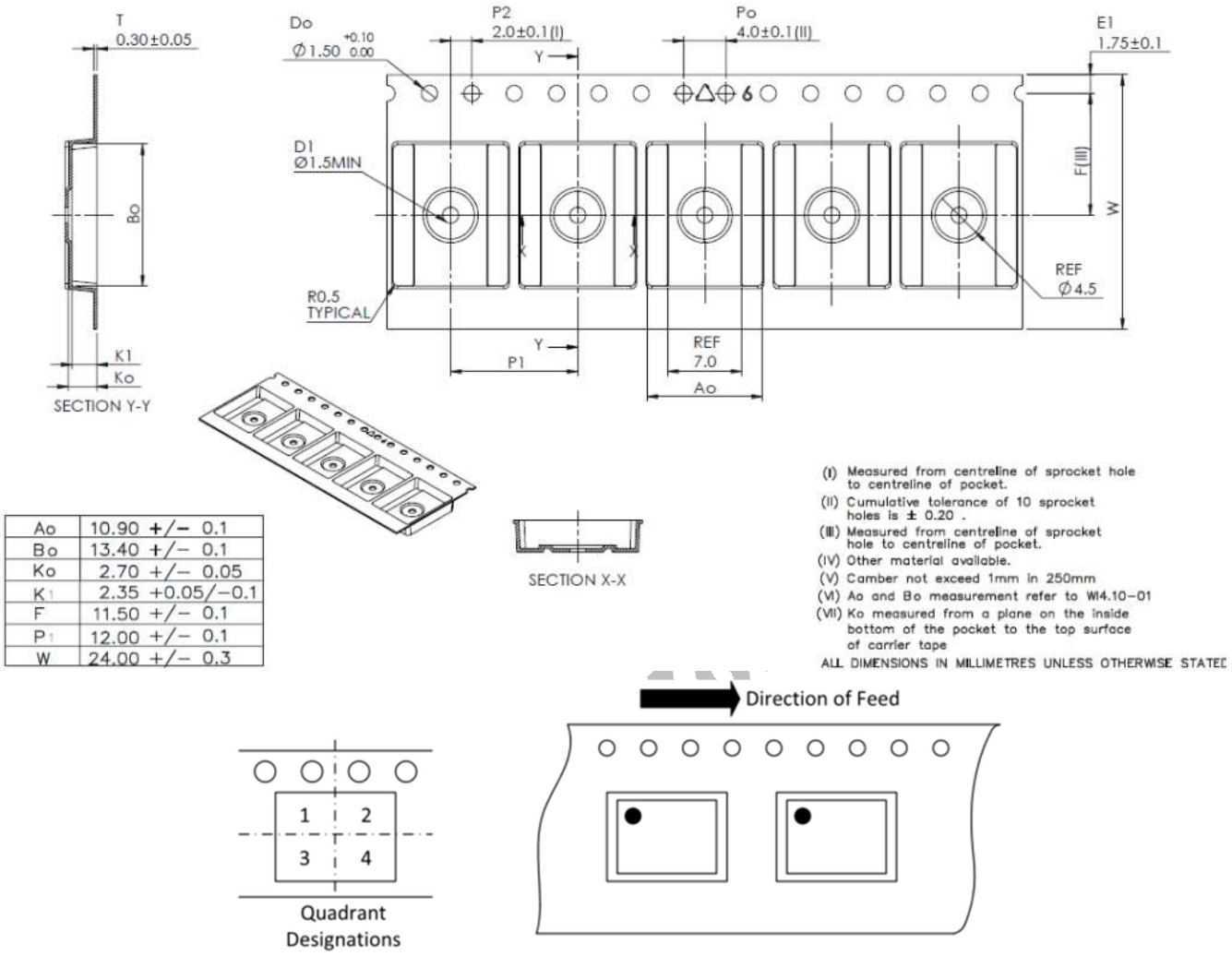




PRODUCT SPECIFICATION						
TAPE WIDTH	øA ±2.0	øN ±2.0	W1	W2 (MAX)	W3	E (MIN)
08MM	330	178	8.4 +1.5 −0.0	14.4	SHALL ACCOMMODATE TAPE WIDTH WITHOUT INTERFERENCE	5.5
12MM	330	178	12.4 +2.0 −0.0	18.4		5.5
16MM	330	178	16.4 +2.0 −0.0	22.4		5.5
24MM	330	178	24.4 +2.0 −0.0	30.4		5.5
32MM	330	178	32.4 +2.0 −0.0	38.4		5.5

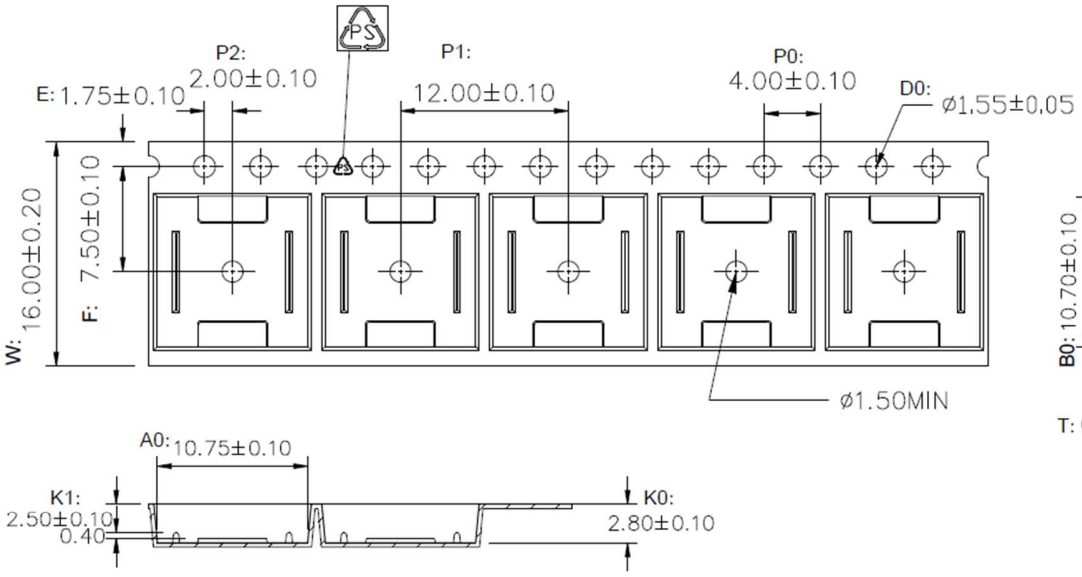
SURFACE RESISTIVITY			
LEGEND	SR RANGE	TYPE	COLOUR
A	BELOW 10^{12}	ANTISTATIC	ALL TYPES
B	10^{6} TO 10^{11}	STATIC DISSIPATIVE	BLACK ONLY
C	10^{5} & BELOW 10^{5}	CONDUCTIVE (GENERIC)	BLACK ONLY
E	10^{9} TO 10^{11}	ANTISTATIC (COATED)	ALL TYPES

Figure 13.1 Tape Information



Ao	10.90 +/− 0.1
Bo	13.40 +/− 0.1
Ko	2.70 +/− 0.05
K1	2.35 +0.05/−0.1
F	11.50 +/− 0.1
P1	12.00 +/− 0.1
W	24.00 +/− 0.3

Figure 13.2 Reel Information of SOW20



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

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

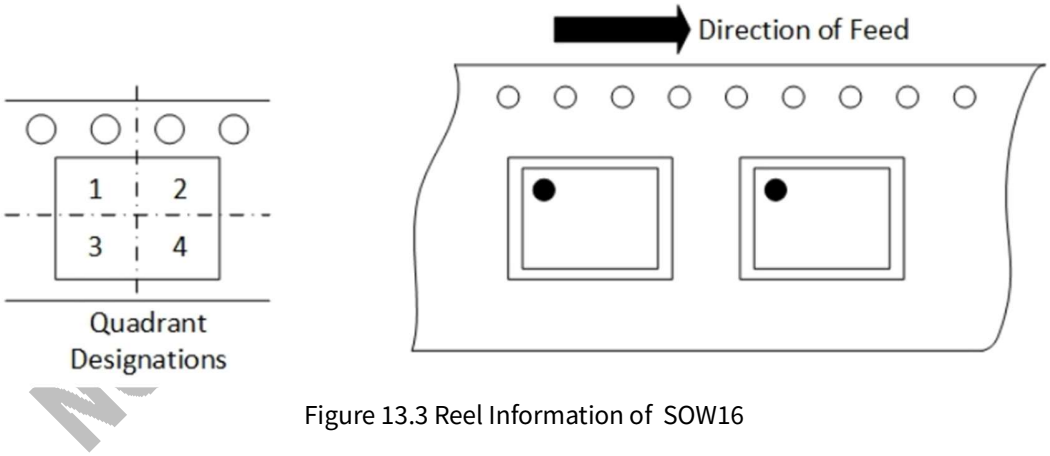


Figure 13.3 Reel Information of SOW16

14. Revision History

Revision	Description	Date
0.0	Initial Version	2025/3/16

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