

Product Overview

NSI84085 is a high reliability isolated half duplex RS-485 transceiver based on NOVOSENSE digital isolation technology. The NSI84085 is safety certified by UL1577 support 3kV_{RMS} or 5kV_{RMS} insulation withstand voltages, while providing high electromagnetic immunity and low emissions at low power consumption.

The Bus pins of NSI84085 is protected from $\pm 8\text{kV}$ system level ESD to GND₂ on Bus side. The device feature fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. The device has a 1/8-unit-load receiver input impedance that allows up to 256 transceivers on the bus.

The data rate of NSI84085 is 8Mbps. The device is slew limited to reduce EMI and reflections with improperly terminated transmission line.

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: $\pm 150\text{kV}/\mu\text{s}$
- High system level EMC performance:
Bus Pins meet IEC61000-4-2 $\pm 8\text{kV}$ ESD
- Fail-safe protection receiver
- Up to 256 transceivers on the bus
- Operation temperature: $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$
- RoHS-compliant packages:
SOP16(300mil), SSOP16(150mil)

Safety Regulatory Approvals

- UL recognition:
 - SOP16(300mil): 5000V_{rms} for 1 minute per UL1577
 - SSOP16(150mil): 3000V_{rms} for 1 minute per UL1577
- CQC certification per GB4943.1
- CSA component notice 5A
- DIN EN IEC 60747-17 (VDE 0884-17)

Applications

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

Device Information

Part Number	Package	Body Size
NSI84085-DSWR	SOP16 (300mil)	10.30mm × 7.50mm
NSI84085-DSSR	SSOP16	5.40mm × 3.90mm

Functional Block Diagrams

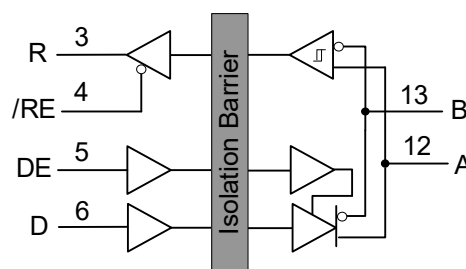


Figure 1. NSI84085 Block Diagrams

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1. Pin Configuration and Functions

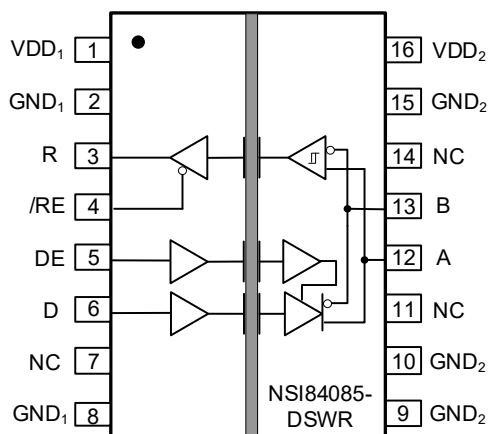


Figure 1.1 SOP16(300mil) Package Top View

Table1.1 SOP16(300mil) Pin Configuration and Description

SOP16(300mil) PIN NO.	SYMBOL	FUNCTION
1	VDD ₁	Power Supply for Isolator Side 1
2,8	GND ₁	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.
7,11,14	NC	No Connection.
9,10,15	GND ₂	Ground 2, the ground reference for Isolator Side 2
12	A	Noninverting Driver Output/Receiver Input. When the driver is disabled, or when VDD ₁ or VDD ₂ 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 ₁ or VDD ₂ is powered down, Pin B is put into a high impedance state to avoid overloading the bus.
16	VDD ₂	Power Supply for Isolator Side 2

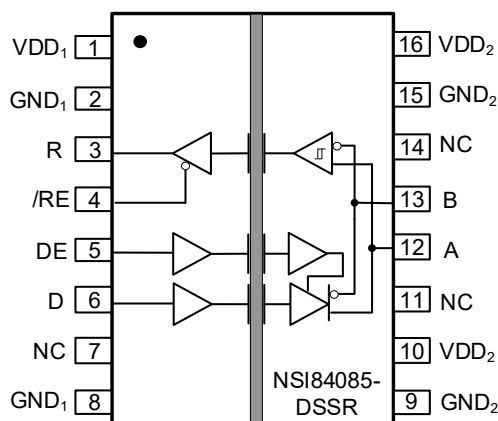


Figure 1.2 SSOP16(150mil) Package Top View

Table1.2 SSOP16(150mil) Pin Configuration and Description

SSOP16(150mil) PIN NO.	SYMBOL	FUNCTION
1	VDD ₁	Power Supply for Isolator Side 1
2,8	GND ₁	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.
7,11,14	NC	No Connection.
9,15	GND ₂	Ground 2, the ground reference for Isolator Side 2
10,16	VDD ₂	Power Supply for Isolator Side 2
12	A	Noninverting Driver Output/Receiver Input. When the driver is disabled, or when VDD ₁ or VDD ₂ 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 ₁ or VDD ₂ is powered down, Pin B is put into a high impedance state to avoid overloading the bus.

2. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) [\(1\)](#) [\(2\)](#)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power Supply Voltage	VDD ₁ , VDD ₂	-0.5		6	V	VDD ₁ to GND ₁ , VDD ₂ to GND ₂

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Logic voltage level	R, /RE, DE, D	-0.5		$V_{DD1}+0.5^{(3)}$	V	R, /RE, DE, D
Voltage on bus pins	V_A, V_B	-18		18	V	A, B with respect to GND_2
Differential input voltage, A with respect to B	V_{ID}	-18		18	V	V_A-V_B
Receiver Output Current	I_O	-10		10	mA	on pin R
Junction Temperature	T_J	-40		150	°C	
Storage Temperature	T_{stg}	-65		150	°C	

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

(2) All voltage values except differential I/O bus voltages are with respect to the local ground terminal (GND_1 or GND_2) and are peak voltage values.

(3) Maximum voltage must not exceed 6 V.

3. ESD Ratings ⁽¹⁾

Parameters	Ratings	Value	Unit
Electrostatic discharge (ESD)	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽²⁾	All pins	±8000
		Bus terminals (A, B) to GND_2	±20000
	Charged device model (CDM), per JEDEC specification JESD22-C101 ⁽³⁾	All pins	±2000
		Bus terminals (A, B) to GND_2	±8000

(1) Though this device features proprietary protection circuitry, proper ESD precautions should be considered to avoid performance degradation of damage due to high energy ESD event. Charged devices and circuit boards may discharge without detection.

(2) Safe manufacturing requires 500-V HBM and standard ESD precautions, per JEDEC document JEP155.

(3) Safe manufacturing requires 250-V CDM and standard ESD precautions, per JEDEC document JEP157.

4. Recommended Operating Conditions

Parameters	Symbol	min	typ	max	unit	Comments
Power Supply Voltage	V_{DD1}	2.5		5.5	V	V_{DD1} to GND_1
	V_{DD2}	3.0		5.5	V	V_{DD2} to GND_2
Voltage at bus pins (separately or common mode)	V_I	-7		12	V	A, B with respect to GND_2
Differential input voltage	V_{ID}	-12		12	V	
High Level Input Voltage	V_{IH}	$0.7 \cdot V_{DD1}$		V_{DD1}	V	on pins D, DE, /RE

Parameters	Symbol	min	typ	max	unit	Comments
Low Level Input Voltage	V _{IL}	0		0.3* VDD ₁	V	on pins D, DE, /RE
Output current	I _O	-4		4	mA	on pin R
Operating ambient temperature	T _A	-40		125	°C	
Maximum Data Rate	f _{MAX}			8	Mbps	

5. Thermal Information

Parameters	Symbol	SOP16(300mil)	SSOP16(150mil)	Unit
IC Junction-to-Air Thermal Resistance	θ _{JA}	67.9	87.1	°C /W
Junction-to-case (top) thermal resistance	θ _{JC (top)}	27.7	48.1	
Junction-to-board thermal resistance	θ _{JB}	29.4	21.5	
Junction-to-top characterization parameter	Ψ _{JT}	7	8.2	
Junction-to-board characterization parameter	Ψ _{JB}	23	21.2	

6. Specifications

6.1. DC Electrical Characteristics

(VDD₁=2.5V~5.5V, VDD₂=3.0V~5.5V, T_A=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD₁ = 3.3V, VDD₂ = 5V, T_A = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Supply characteristics						
Power supply voltage	VDD ₁	2.5	3.3	5.5	V	VDD ₁ to GND ₁
	VDD ₂	3.0	5	5.5	V	VDD ₂ to GND ₂
Power on Reset	V _{POR} (VDD ₁)	2	2.2	2.4	V	POR threshold for VDD ₁ as during power-up
	V _{POR} (VDD ₂)	2.2	2.5	2.8	V	POR threshold for VDD ₂ as during power-up
POR threshold Hysteresis	V _{hys} (VDD ₁)		0.1		V	on pin VDD ₁
	V _{hys} (VDD ₂)		0.3		V	on pin VDD ₂
Logic-side supply current	I _{DD1}		1.15	2	mA	DE=/RE=Low, D = High
			3.04	4.7	mA	DE= High, /RE=D =Low
Bus-side supply current	I _{DD2}		1.72	3	mA	DE=Low, bus load or no load

Parameters	Symbol	Min	Typ	Max	Unit	Comments
			65	80	mA	DE=High, D =1Mbps, R _L =54Ω, C _L =50pF
Device characteristics						
Thermal-Shutdown Threshold	T _{TS}		165		°C	
Thermal-Shutdown Hysteresis	T _{TSH}		15		°C	
Common Mode Transient Immunity	CMTI	±100	±150		kV/μs	See Figure 6.6
Logic Side						
Rising input switching threshold	V _{IT+}			0.7*VDD ₁		on pins DE, D, /RE
Falling input switching threshold	V _{IT-}	0.3*VDD ₁			V	on pins DE, D, /RE
Input Pull up Current	I _{PU}			20	μA	on pins DE, D, /RE
Input Pull down Current	I _{PD}	-20			μA	on pins DE, D, /RE
Output Voltage High	V _{OH}	VDD ₁ -0.3			V	on pin R, I _{OH} = -4mA
Output Voltage Low	V _{OL}			0.3	V	on pin R, I _{OL} = 4mA
Output Short-Circuit Current	I _{OSR}			150	mA	on pin R, 0 ≤ V _R ≤ VDD ₁
Three-State Output Current	I _{OZ}	-15			μA	on pin R, 0 ≤ V _R ≤ VDD ₁ , /RE = high
Input Capacitance	C _{IN}		2		pF	DE, D, /RE
Driver electrical characteristics; pins A and B						
Differential Output Voltage	V _{OD}			VDD ₂	V	No Load
		2.7	3.6		V	See Figure 6.1 , R _L =100Ω (RS-422), VDD ₂ =5V
		1.5			V	See Figure 6.1 , R _L =100Ω (RS-422), VDD ₂ =3.3V
		2.1	3.3		V	See Figure 6.1 , R _L =54Ω (RS-485), VDD ₂ =5V
		1.5			V	See Figure 6.1 , R _L =54Ω (RS-485), VDD ₂ =3.3V
		1.5	3.2			See Figure 6.2 , R _L =60Ω , 375Ω on each output to -7V to 12V
Change in magnitude of the differential output voltage	Δ V _{OD}	-0.2		0.2	V	See Figure 6.1 , R _L =100Ω or R _L =54Ω

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Common-Mode Output Voltage	V _{OC}	1	VDD ₂ /2	3	V	See Figure 6.1 , R _L =100Ω or R _L =54Ω
Change in Magnitude of Common-Mode Voltage	ΔV _{OC (SS)}	-0.2		0.2	V	See Figure 6.1 , R _L =100Ω or R _L =54Ω
Peak-to-peak driver common mode output voltage	V _{OC(PP)}		450		mV	See Figure 6.1
Driver Short-Circuit Output Current	I _{OSD}			250	mA	0 ≤ V _{OUT} ≤ +12 V
		-250			mA	−7V ≤ V _{OUT} ≤ VDD ₂
Receiver electrical characteristics; pins A and B						
Input Current (A and B)	I _A , I _B			200	μA	DE= Low, VDD ₂ =GND, V _{IN} =12V
		-200			μA	DE=Low, VDD ₂ =GND, V _{IN} =-7V
Positive-going receiver differential input voltage threshold	V _{TH+}			-10	mV	−7V ≤ V _{CM} ≤ 12V, DE=/RE= Low
Negative-going receiver differential input voltage threshold	V _{TH-}	-200			mV	−7V ≤ V _{CM} ≤ 12V, DE=/RE= Low
Receiver differential input voltage threshold hysteresis	V _{HYS}		50		mV	−7V ≤ V _{CM} ≤ 12V, DE=/RE= Low
Receiver Input Resistance	R _{IN}	96			kΩ	−7V ≤ V _{CM} ≤ 12V, DE= Low

6.2. Switching Electrical Characteristics

($V_{DD1}=2.5V \sim 5.5V$, $V_{DD2}=3.0V \sim 5.5V$, $T_A=-40^{\circ}C$ to $125^{\circ}C$. Unless otherwise noted, Typical values are at $V_{DD1} = 3.3V$, $V_{DD2} = 5V$, $T_A = 25^{\circ}C$)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Driver Switching Characteristics						
Driver Propagation Delay	t_{PLH}		93	120	ns	See Figure 6.3, $R_L=54\Omega$, $C_L=50pF$
	t_{PHL}		94	120	ns	See Figure 6.3, $R_L=54\Omega$, $C_L=50pF$
Driver Pulse Width Distortion, $ t_{PHL} - t_{PLH} $	PWD		1	10	ns	See Figure 6.3, $R_L=54\Omega$, $C_L=50pF$
Driver Output Falling Time or Rising time	t_F		5	10	ns	See Figure 6.3, $R_L=54\Omega$, $C_L=50pF$

Parameters	Symbol	Min	Typ	Max	Unit	Comments
	t_R		5	10	ns	See Figure 6.3, $R_L=54\Omega$, $C_L=50pF$
Driver Enable to Output High	t_{ZH}		140	240	ns	See Figure 6.4, $R_L=110\Omega$, $C_L=50pF$
Driver Enable to Output Low	t_{ZL}		140	240	ns	See Figure 6.4, $R_L=110\Omega$, $C_L=50pF$
Driver Output High to Disable	t_{HZ}		440	650	ns	See Figure 6.4, $R_L=110\Omega$, $C_L=50pF$
Driver Output Low to Disable	t_{LZ}		420	650	ns	See Figure 6.4, $R_L=110\Omega$, $C_L=50pF$
Receiver Switching Characteristics						
Receiver Propagation Delay	t_{PLH}		89	160	ns	See Figure 6.5, $C_L=15pF$
	t_{PHL}		92	160	ns	See Figure 6.5, $C_L=15pF$
Receiver Pulse Width Distortion, $ t_{PHL} - t_{PLH} $	PWD		3	25	ns	See Figure 6.5, $C_L=15pF$
Receiver Output Falling Time or Rising time	t_F		2	5	ns	See Figure 6.5, $C_L=15pF$
	t_R		2	5	ns	See Figure 6.5, $C_L=15pF$
Receiver Enable to Output High	t_{ZH}		9	30	ns	See Figure 6.6, $R_L=1k\Omega$, $C_L=15pF$
Receiver Enable to Output Low	t_{ZL}		9	30	ns	See Figure 6.6, $R_L=1k\Omega$, $C_L=15pF$
Receiver Disable to Output High	t_{HZ}		8	30	ns	See Figure 6.6, $R_L=1k\Omega$, $C_L=15pF$
Receiver Disable to Output Low	t_{LZ}		7	30	ns	See Figure 6.6, $R_L=1k\Omega$, $C_L=15pF$

6.3. Parameter Measurement Information

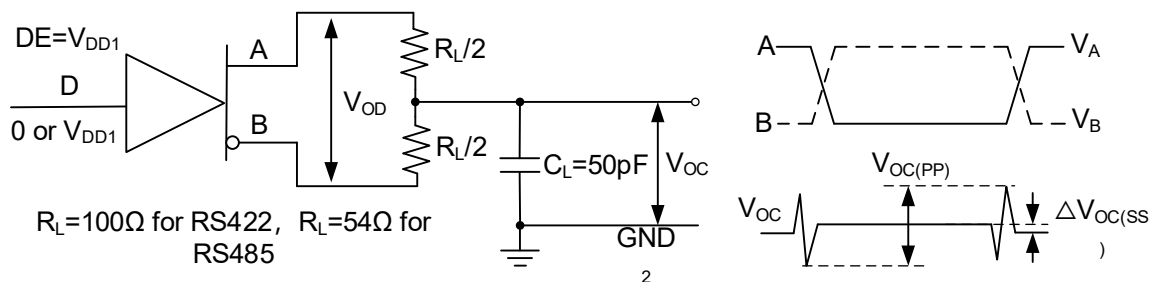


Figure 6.1 Measurement of Driver Common-Mode Output Voltage With RS-485 Load

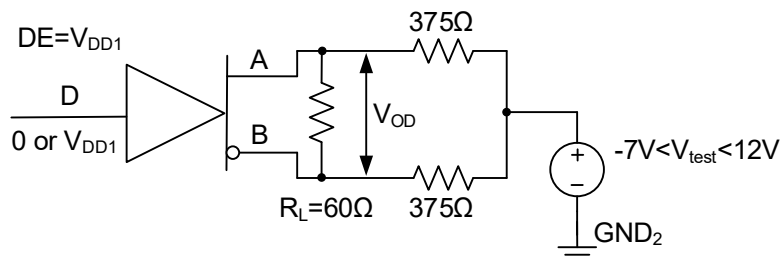
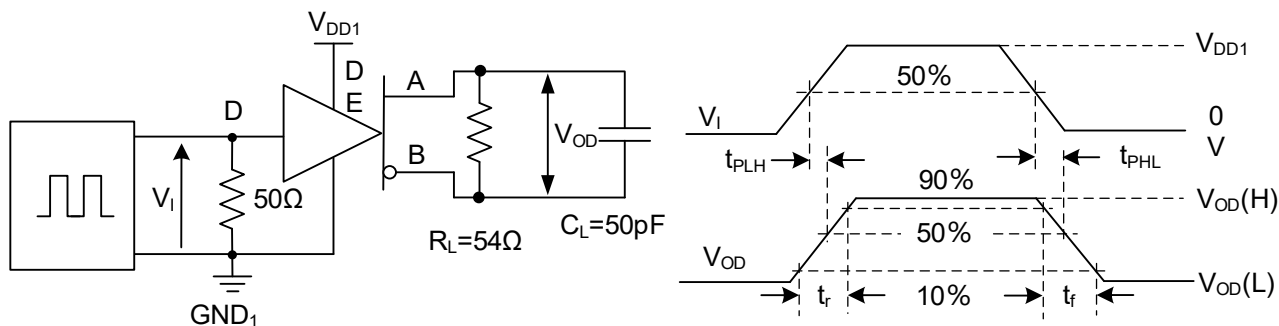
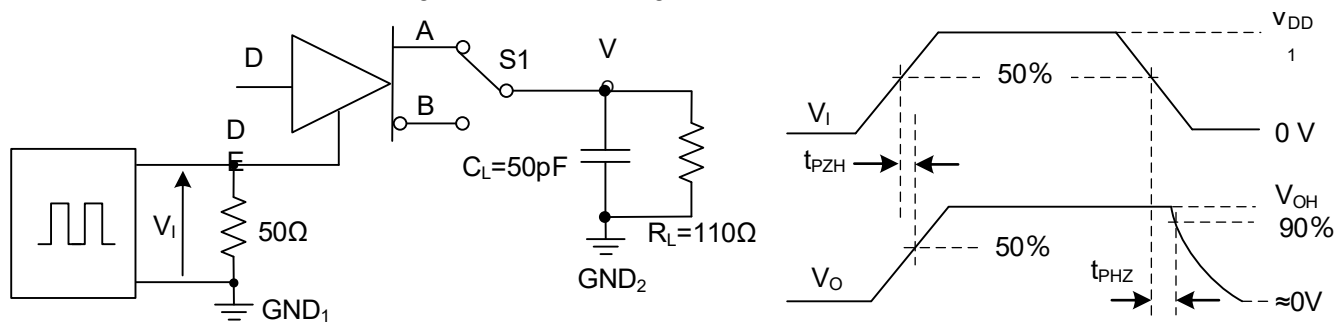


Figure 6.2 Measurement of Driver Differential Output Voltage with Common-Mode Load



(1) Input Generator Characteristics: PRR≤50kHz, tr≤3ns, tf≤3ns, Duty cycle=50%, Zo=50Ω

Figure 6.3 Driver Timing Test Circuit and waveform



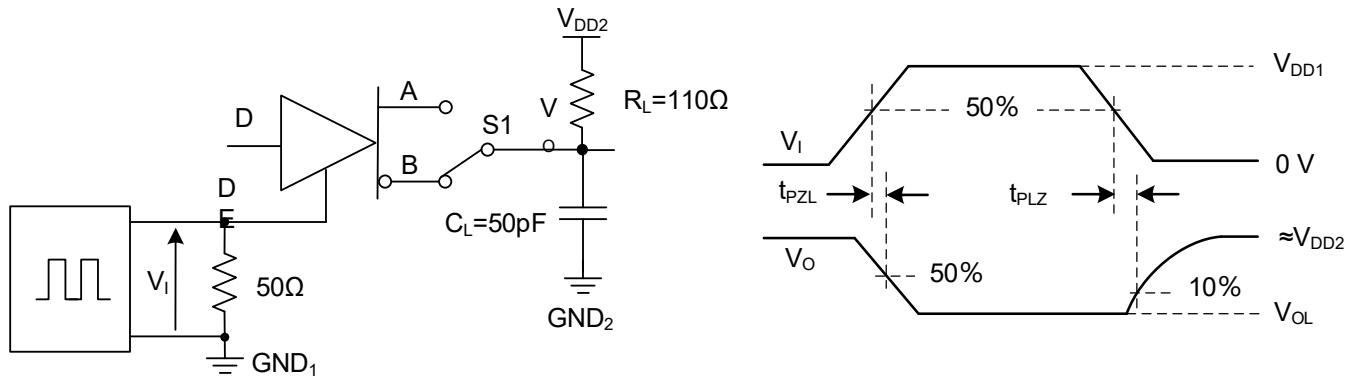


Figure 6.4 Driver Enable Disable Timing Test Circuit and waveform

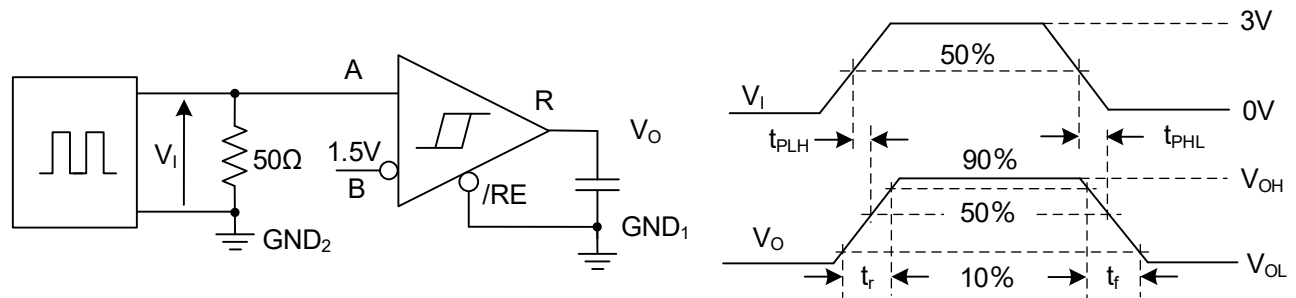


Figure 6.5 Receiver Propagation Delay Test Circuit and waveform

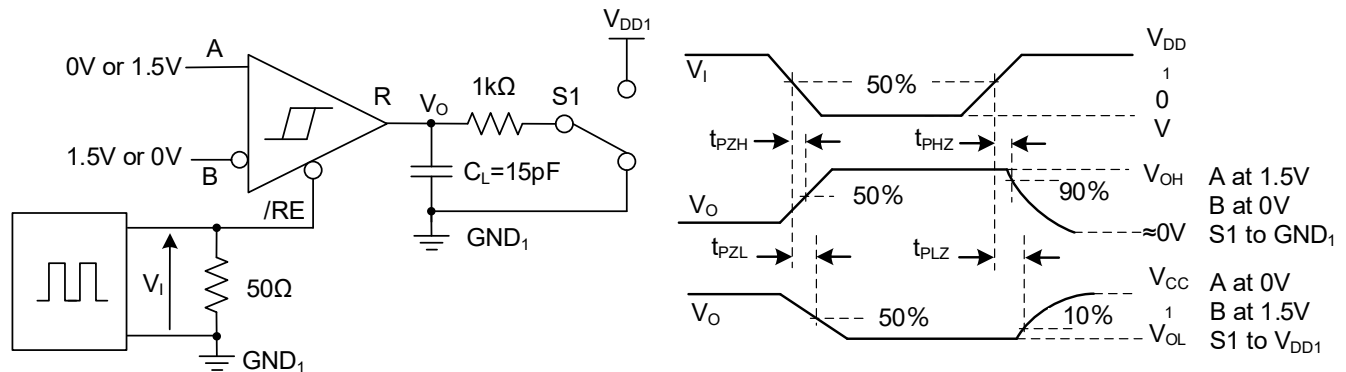


Figure 6.6 Receiver Enable Disable Timing Test Circuit and waveform

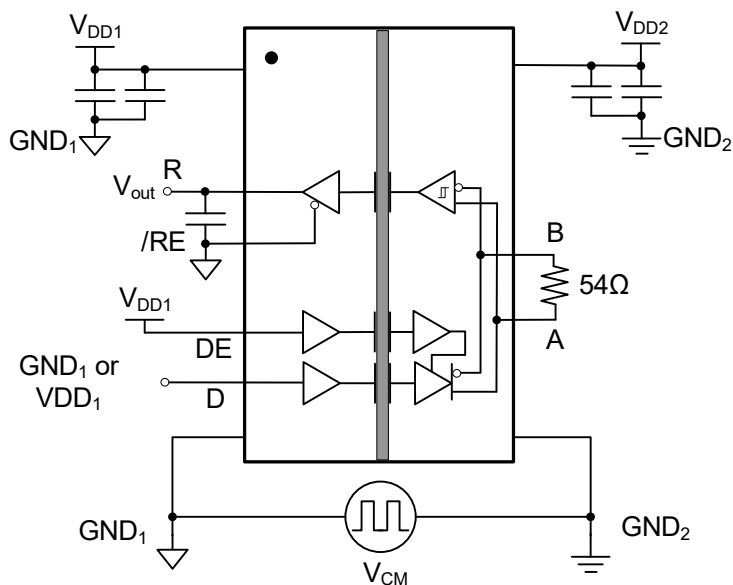


Figure 6.7 Common-Mode Transient Immunity Test Circuit

6.4. Typical Performance Characteristics

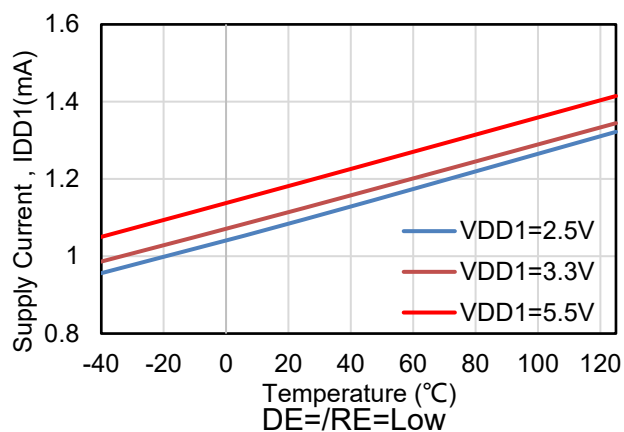


Figure 6.8 VDD₁ supply current vs Temperature

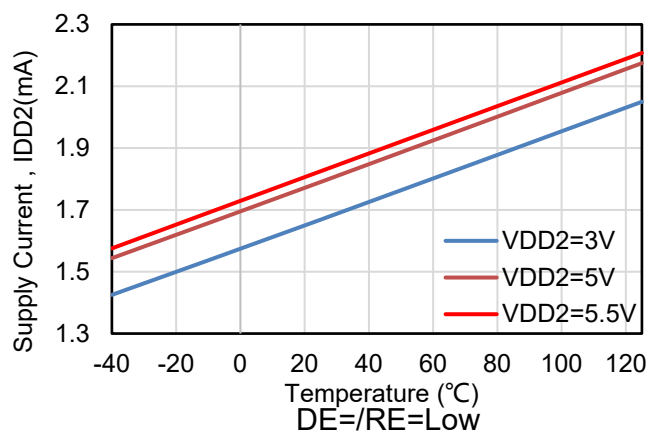


Figure 6.9 VDD₂ supply current vs Temperature

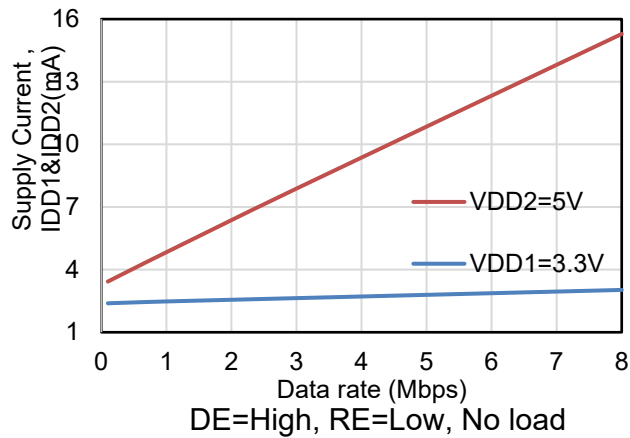


Figure 6.10 Supply current vs Data Rate-No Load

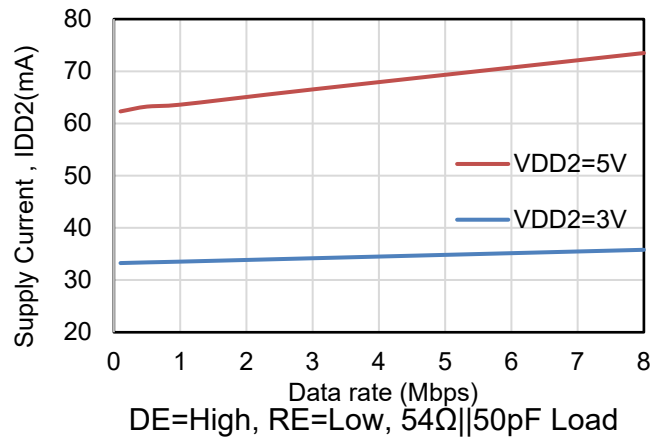


Figure 6.11 Supply current vs Data Rate-With 54Ω||50pF Load

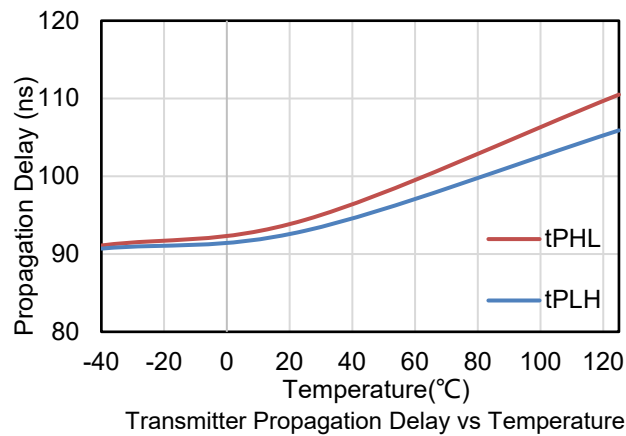


Figure 6.12 Transmitter Propagation Delay vs Temperature

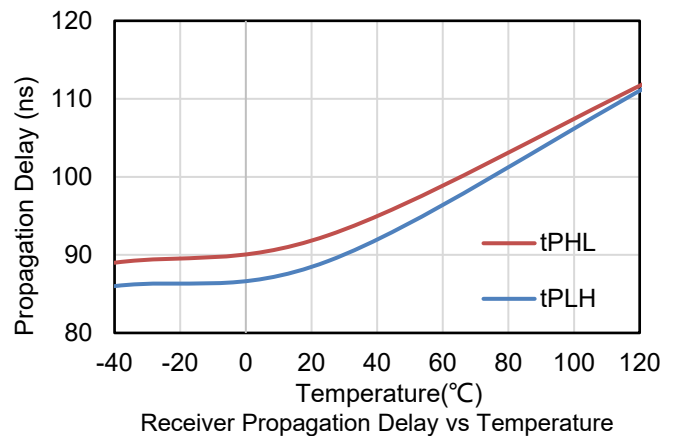


Figure 6.13 Receiver Propagation Delay vs Temperature

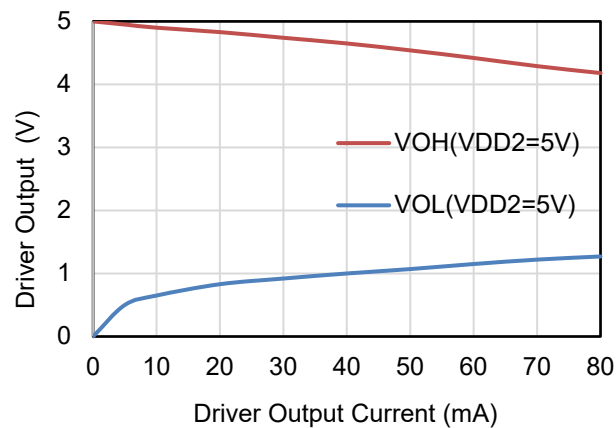


Figure 6.14 Driver output voltage vs Output current

7. High Voltage Feature Description

7.1. Insulation and Safety Related Specifications

Parameters	Symbol	Value		Unit	Comments
		SOP16(300mil)	SSOP16(150mil)		
Minimum External Clearance	CLR	8	4	mm	IEC 60664-1:2007
Minimum External Creepage	CPG	8	4	mm	IEC 60664-1:2007
Distance Through Insulation	DTI	24		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	
		SSOP16(150mil)	SOP16(300mil)
Overvoltage Category per IEC60664-1	For Rated Mains Voltage $\leq 150V_{rms}$	I to IV	I to IV
	For Rated Mains Voltage $\leq 300V_{rms}$	I to III	I to IV
	For Rated Mains Voltage $\leq 600V_{rms}$	/	I to IV
	For Rated Mains Voltage $\leq 1000V_{rms}$	/	I to III
Climatic Classification		40/125/21	40/125/21
Pollution Degree per DIN VDE 0110		2	2

7.2. Insulation Characteristics

			Value		
Description	Test Condition	Symbol	SOP16 (300mil)	SSOP16 (150mil)	Unit
	DIN EN IEC 60747-17 (VDE 0884-17)				
Maximum Working Isolation Voltage	AC voltage	V _{IOWM}	1500	400	V _{RMS}
	DC voltage		2121	565	V _{DC}
Maximum Repetitive Isolation Voltage		V _{IORM}	2121	565	V _{PEAK}
Apparent Charge ^[1]	Method a, after Input/output safety test subgroup 2/3, V _{ini} =V _{IOTM} , t _{ini} = 60 s, V _{pd(m)} =1.2*V _{IORM} , t _m =10s.	q _{pd}	<5	/	pC

Description	Test Condition	Symbol	Value		Unit
			SOP16 (300mil)	SSOP16 (150mil)	
	Method a, after environmental tests subgroup 1, $V_{ini}=V_{IOTM}$, $t_{ini}=60s$, $V_{pd(m)}=1.6 \cdot V_{IORM}$, $t_m=10s$	q_{pd}	/	<5	pC
	Method b, routine test (100% production) and preconditioning (type test); $V_{ini}=1.2 \cdot V_{IOTM}$, $t_{ini}=1s$ $V_{pd(m)}=1.875 \cdot V_{IORM}$, $t_m=1s$ (method b1) or $V_{pd(m)}=V_{ini}$, $t_m=t_{ini}$ (method b2)				
	Method a, after Input/output safety test subgroup 2/3, $V_{ini}=V_{IOTM}$, $t_{ini}=60s$, $V_{pd(m)}=1.2 \cdot V_{IORM}$, $t_m=10s$.				
	Method a, after environmental tests subgroup 1, $V_{ini}=V_{IOTM}$, $t_{ini}=60s$, $V_{pd(m)}=1.3 \cdot V_{IORM}$, $t_m=10s$				
	Method b, routine test (100% production) and preconditioning (type test); $V_{ini}=1.2 \cdot V_{IOTM}$, $t_{ini}=1s$ $V_{pd(m)}=1.5 \cdot V_{IORM}$, $t_m=1s$ (method b1) or $V_{pd(m)}=V_{ini}$, $t_m=t_{ini}$ (method b2)				
Maximum transient isolation voltage	$t = 60 \text{ sec}$	V_{IOTM}	8000	5000	V_{PEAK}
Maximum impulse voltage	Test method per IEC62368-1, 1.2/50 μs waveform, $V_{IOSM} \geq V_{IMP} \times 1.3$	V_{IMP}	6250	4000	V_{PEAK}
Maximum Surge Isolation Voltage ^[2]	Test method per IEC62368-1, 1.2/50 μs waveform	V_{IOSM}	10000	7000	V_{PEAK}
Isolation resistance ^[3]	$V_{IO} = 500V$, $T_A = 25^\circ C$	R_{IO}	>10 ¹²		Ω
	$V_{IO} = 500V$, $100^\circ C \leq T_A \leq 125^\circ C$		>10 ¹¹		Ω
	$V_{IO} = 500V$, $T_S = 150^\circ C$		>10 ⁹		Ω
Isolation capacitance ^[3]	$f = 1MHz$	C_{IO}	2	0.6	pF
UL1577					
Withstand Isolation Voltage	$V_{TEST} = V_{ISO}$, $t=60s$ (qualification), $V_{TEST} = 1.2 \times V_{ISO}$, $t = 1 \text{ sec}$, 100% production test	V_{ISO}	5000	3000	V_{RMS}

[1] Apparent charge is electrical discharge caused by a partial discharge (pd).

[2] Testing is carried out in air or oil to determine the intrinsic surge immunity of the isolation barrier.

[3] The side 1 terminals as well as the side 2 terminals of the coupler are connected together forming a two-terminal device.

7.3. Safety-Limiting Values

Reinforced isolation safety-limiting values as outlined in VDE-0884-17 of NSI84085-DSWR.

Parameter	Description	Test Condition	Value	Unit
P_s	Safety Supply Power	$R_{\theta JA} = 67.9 \text{ }^{\circ}\text{C/W}^{(1)}$, $T_J = 150 \text{ }^{\circ}\text{C}$, $T_A = 25 \text{ }^{\circ}\text{C}$	1840	mW
I_s	Safety Supply Current	$R_{\theta JA} = 67.9 \text{ }^{\circ}\text{C/W}^{(1)}$, $V_I = 5\text{V}$, $T_J = 150 \text{ }^{\circ}\text{C}$, $T_A = 25 \text{ }^{\circ}\text{C}$	368	mA
T_s	Safety Temperature ²⁾		150	$^{\circ}\text{C}$

- 1) Calculate with the junction-to-air thermal resistance, $R_{\theta JA}$, of SOP16(300mil) package (Thermal Information Table) which is that of a device installed on a low effective thermal conductivity test board (1s) according to JESD51-3.
- 2) The maximum safety temperature has the same value as the maximum junction temperature (T_J) specified for the device.

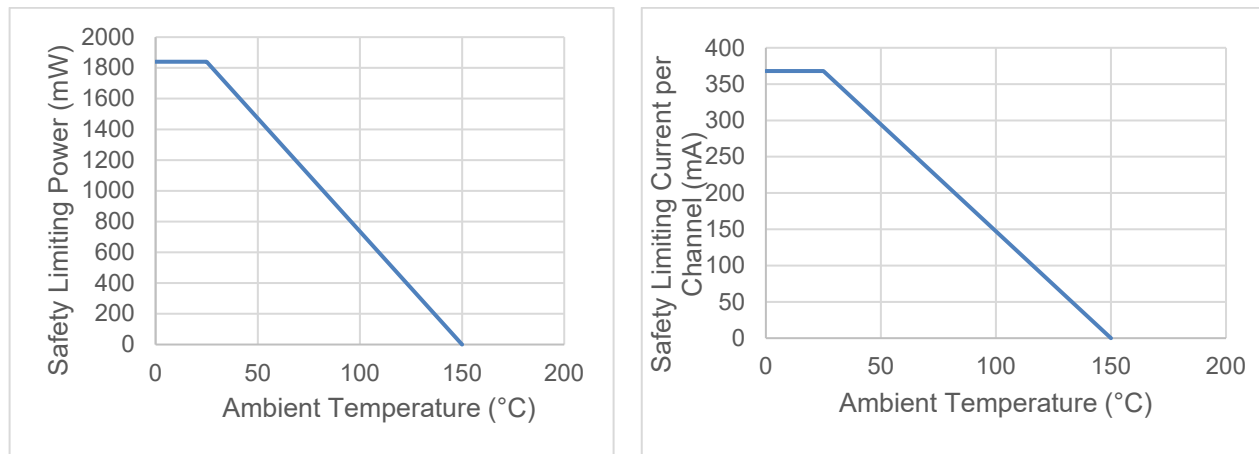


Figure 7.1 NSI84085-DSWR Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN IEC 60747-17 (VDE 0884-17)

Basic isolation safety-limiting values as outlined in VDE-0884-17 of NSI84085-DSSR.

Description	Test Condition	Value	Unit
Safety Supply Power	$R_{\theta JA} = 87.1 \text{ }^{\circ}\text{C/W}^{(1)}$, $T_J = 150 \text{ }^{\circ}\text{C}$, $T_A = 25 \text{ }^{\circ}\text{C}$	1435	mW
Safety Supply Current	$R_{\theta JA} = 87.1 \text{ }^{\circ}\text{C/W}^{(1)}$, $V_I = 5\text{V}$, $T_J = 150 \text{ }^{\circ}\text{C}$, $T_A = 25 \text{ }^{\circ}\text{C}$	287	mA
Safety Temperature ²⁾		150	$^{\circ}\text{C}$

- 1) Calculate with the junction-to-air thermal resistance, $R_{\theta JA}$, of SSOP16(150mil) package ([Thermal Information Table](#)) which is that of a device installed on a low effective thermal conductivity test board (1s) according to JESD51-3.
- 2) The maximum safety temperature has the same value as the maximum junction temperature (T_J) specified for the device.

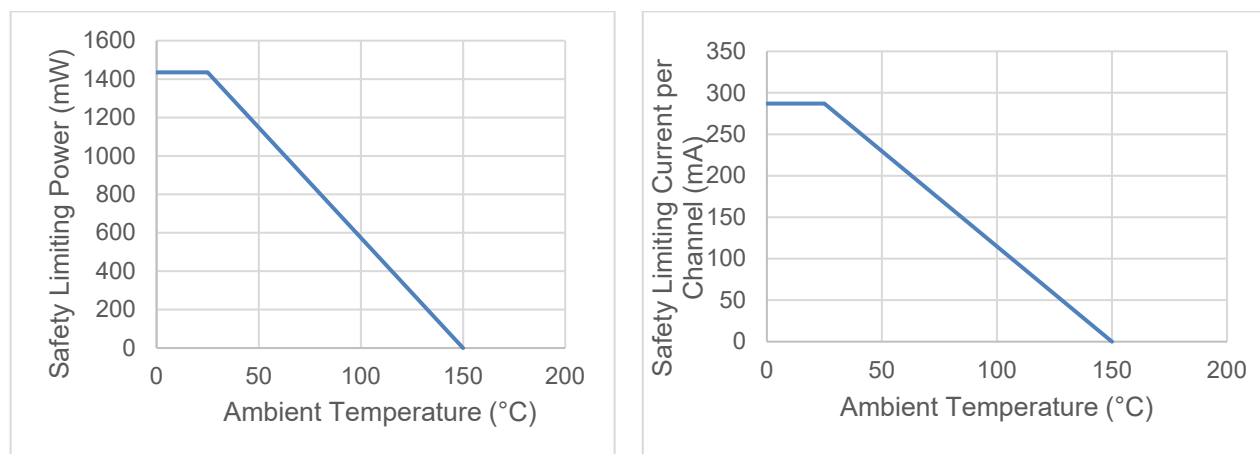


Figure 7.2 NSI84085-DSSR Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN IEC 60747-17 (VDE 0884-17)

7.4. Regulatory information

The NSI84085-DSWR is approved or pending approval by the organizations listed in table.

UL		CQC	TUV	
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	Certified according to GB4943.1	DIN EN IEC 60747-17 (VDE 0884-17)	Certified According to EN IEC 62368-1
Single Protection, 5000V _{RMS} Isolation voltage	Single Protection, 5000V _{RMS} Isolation voltage	Reinforced insulation	Reinforced Insulation V _{IORM} =2121V _{PEAK} V _{IOTM} =8000V _{PEAK} V _{IOSM} =10000V _{PEAK}	Reinforced insulation
E500602		CQC26001518665	R 50632560	R 50574061

The NSI84085-DSSR is approved or pending approval by the organizations listed in table.

UL		VDE	CQC	TUV
UL 1577 Component Recognition Program	Approved under CSA Component Acceptance Notice 5A	DIN EN IEC 60747-17 (VDE 0884-17)	Certified according to GB4943.1	Certified According to EN IEC 62368-1
Single Protection, 3000V _{RMS} Isolation voltage	Single Protection, 3000V _{RMS} Isolation voltage	Reinforced Insulation V _{IORM} =565V _{PEAK} V _{IOTM} =5300V _{PEAK} V _{IOSM} =7000V _{PEAK}	Basic insulation	Basic insulation
E500602		File (pending)	CQC26001518662	R 50574061

8. Function Description

8.1. Overview

NSI84085 is a high reliability isolated half 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 3kV_{RMS} and 5kV_{RMS} insulation withstand voltages.

8.2. Data rate

The data rate of NSI84085 is 8Mbps. The device is slew limited to reduce EMI and reflections with improperly terminated transmission line.

8.3. 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.

8.4. Truth tables

Table 8.1 Driver Function Table¹

VDD1 status	VDD2 status	Input (D)	Enable Input (DE)	Outputs ¹	
				A	B
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

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

Table 8.2 Receiver Function Table¹

VDD1 status	VDD2 status	Differential Input ($V_A - V_B$)	Enable Input (/RE)	Output (R)
PU	PU	$\geq -10\text{mV}$	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

<i>VDD1 status</i>	<i>VDD2 status</i>	<i>Differential Input (V_A-V_B)</i>	<i>Enable Input (/RE)</i>	<i>Output (R)</i>
PU	PD	X	L/Open	H
PD	PD	X	X	Z

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

8.5. Thermal shutdown

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

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 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:

- ± 8kV HBM.
- ±8kV using the Contact Discharge method specified in IEC 61000-4-2

Other pins except bus pins:

- ±8kV HBM.

9.3. Layout considerations

The NSI84085 requires a 0.1 μF 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 pins.

9.4. Typical application

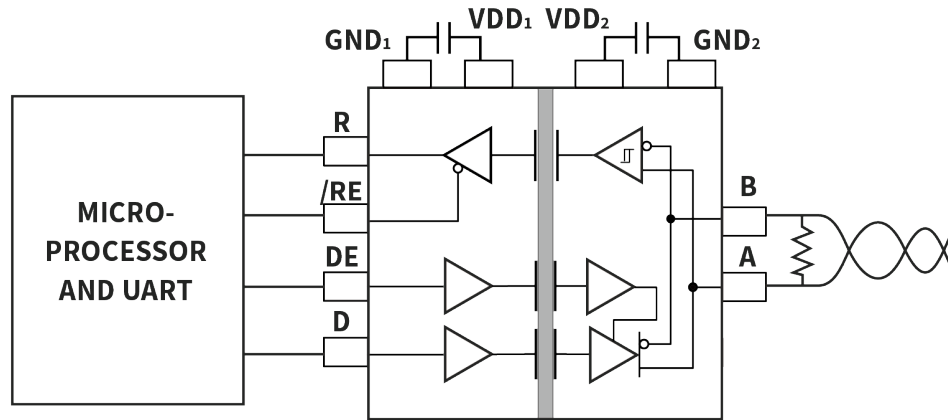


Figure 9.1 NSI84085 typical application circuit

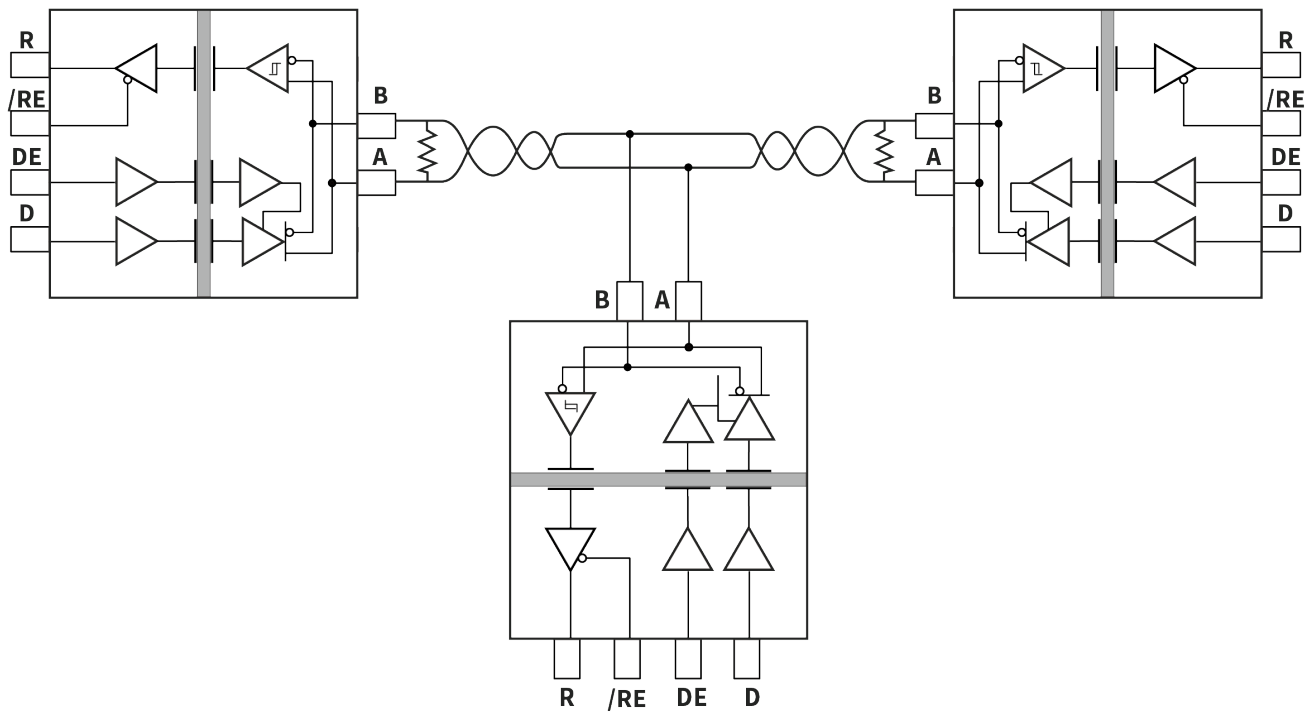
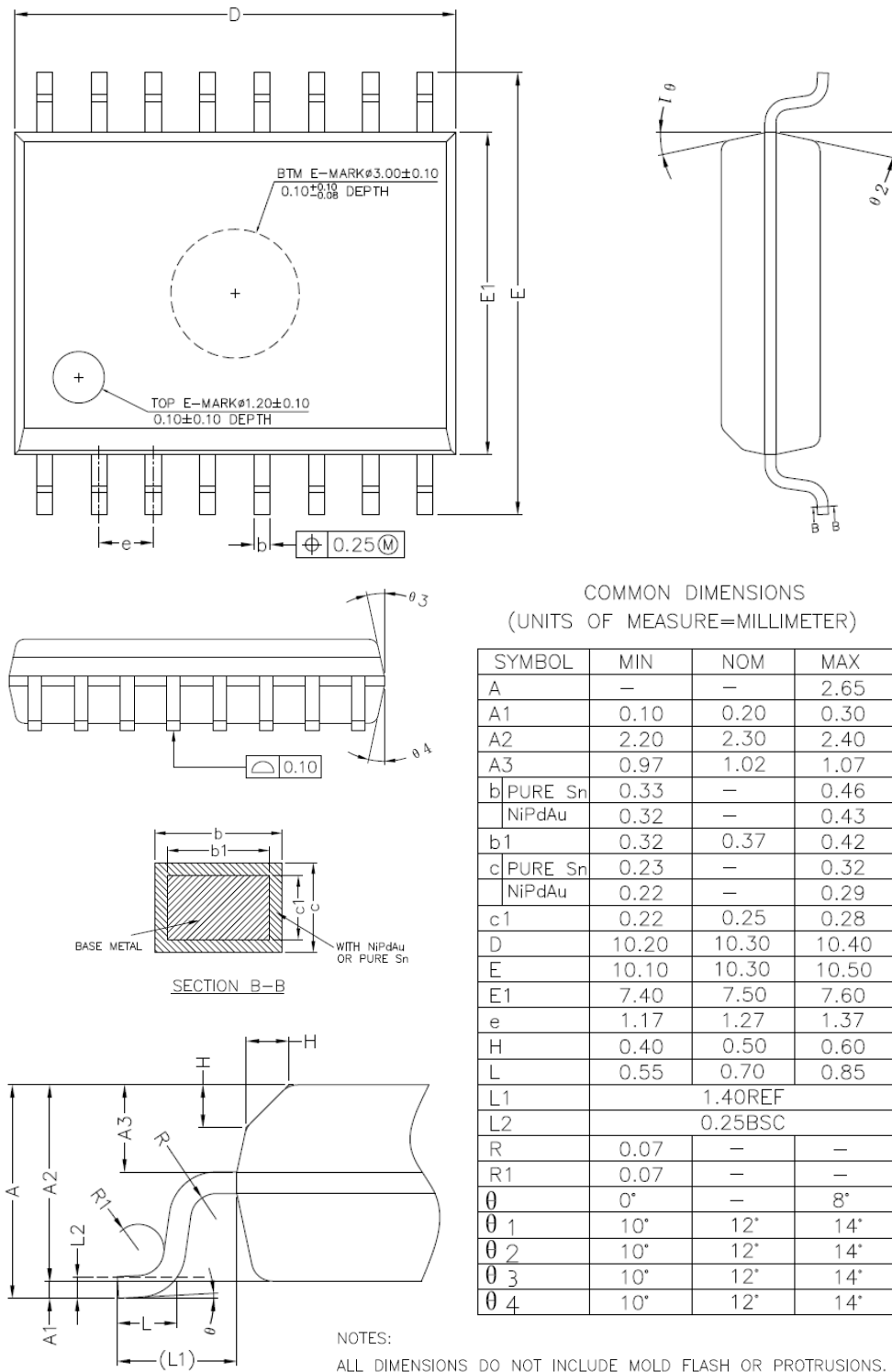


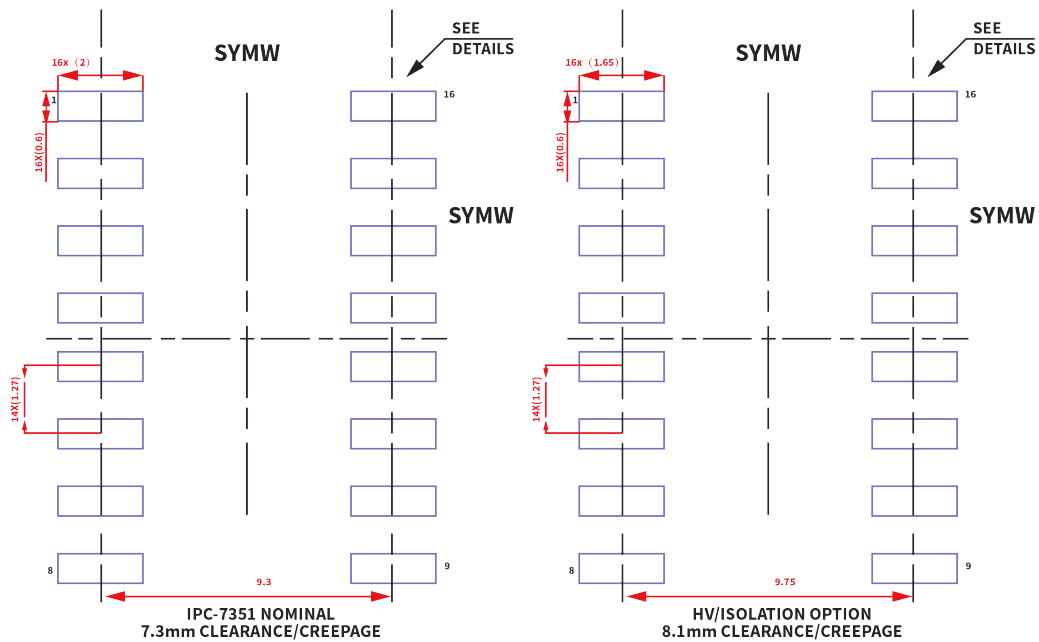
Figure 9.2 Typical isolated Half-Duplex RS-485 application

10. Package Information

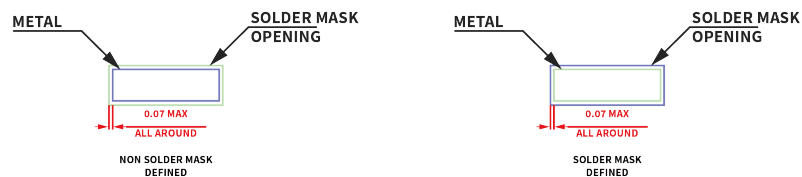


NOTE: This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.

Figure 10.1 SOP16(300mil)/SOW16 Package Shape and Dimension in millimeters

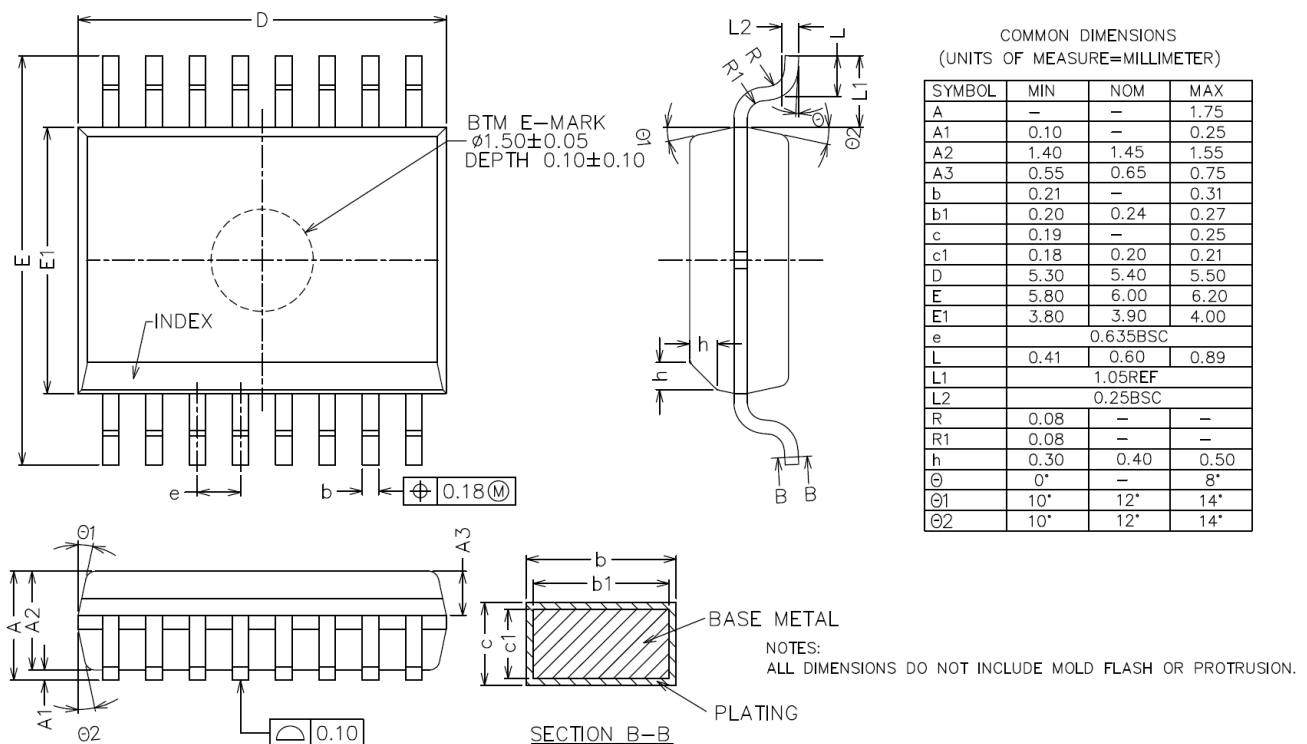


LAND PATTERN EXAMPLE(mm)



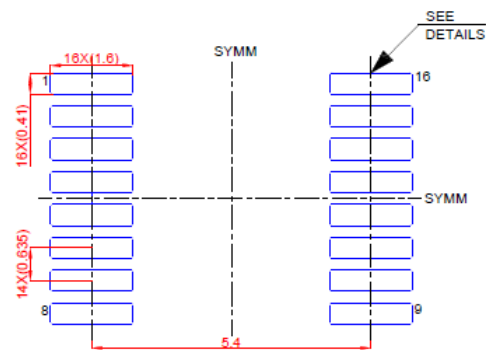
SOLDER MASK DETAILS

Figure 10.2 SOP16(300mil)/SOW16 Package Board Layout Example



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

Figure 10.3 SSOP16 Package Shape and Dimension in millimeters



LAND PATTERN EXAMPLE(mm)

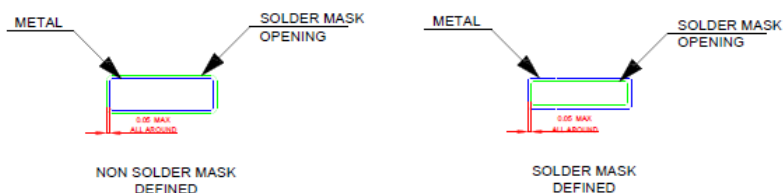


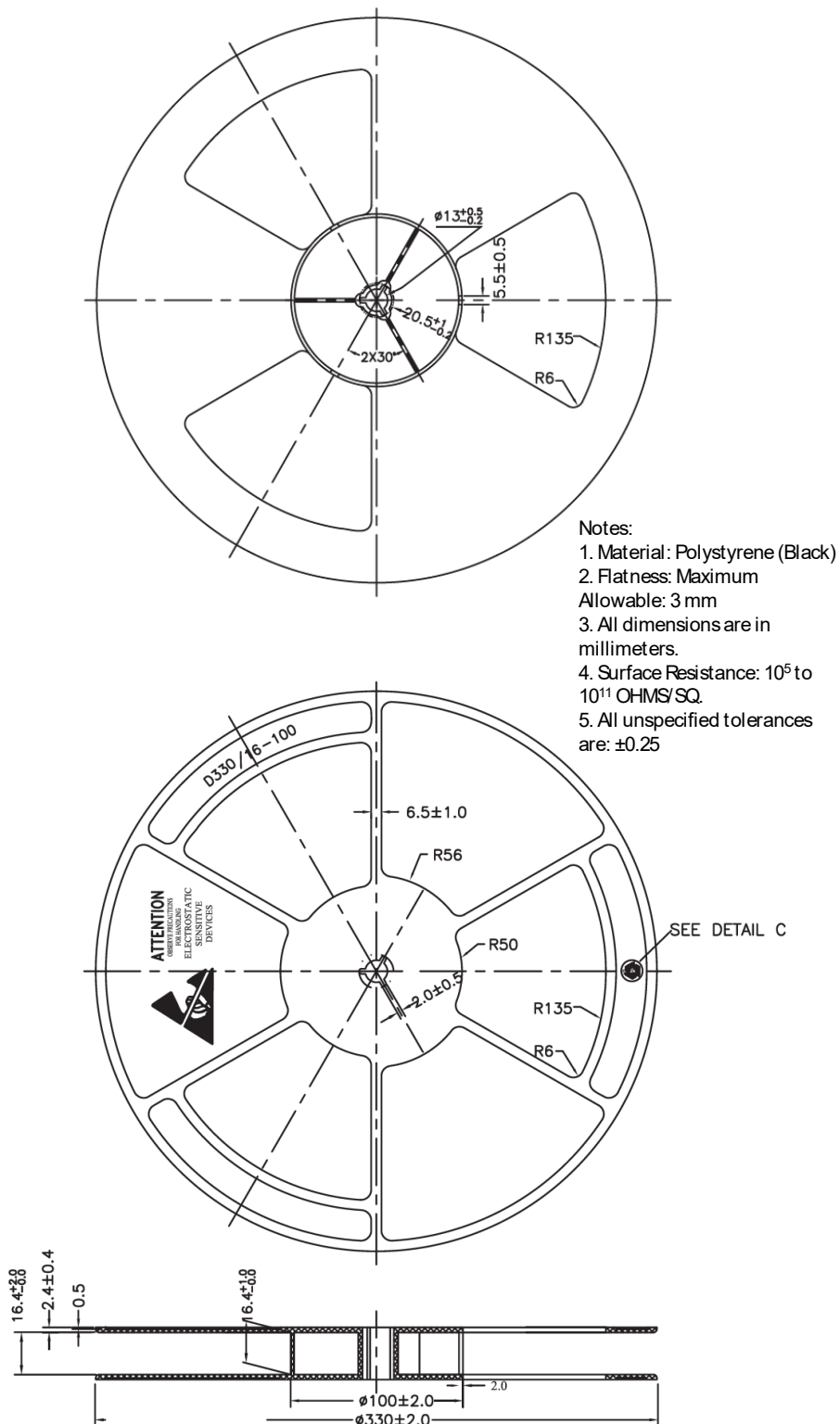
Figure 10.4 SSOP16 Package Board Layout Example

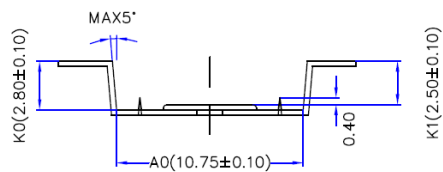
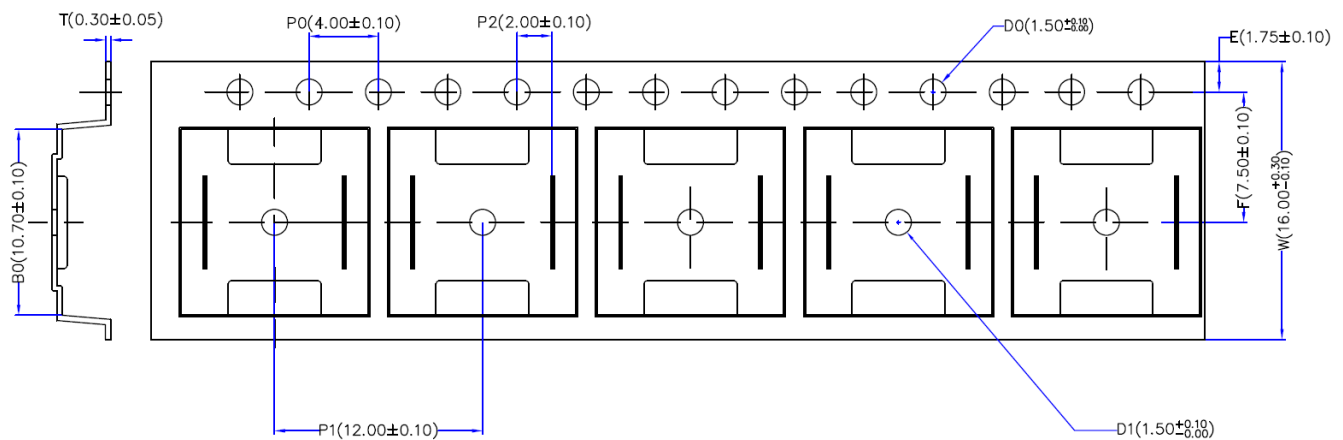
11. Order Information

<i>Orderable Part Number</i>	<i>Isolation Rating (kV)</i>	<i>Max Data Rate (Mbps)</i>	<i>Duplex</i>	<i>SPQ</i>	<i>MPQ</i>	<i>Package Type</i>	<i>Package Drawing</i>	<i>Operating Temperature</i>	<i>MSL</i>
NSI84085-DSWR	5	8	Half	1000	1000	SOP16 (300mil)	SOW16	-40 to 125°C	3
NSI84085-DSSR	3	8	Half	2500	2500	SSOP16 (150mil)	SSOP16	-40 to 125°C	3

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

12. Tape and Reel Information





NOTES:

1. ALL DIMS IN MM
2. MATERIAL: CONDUCTIVE PS
3. The other tolerance not indicated are $\pm 0.1\text{mm}$
4. 10 sprocket hole pitch cumulative tolerance $\pm 0.20\text{mm}$
5. Carrier camber is within 1mm in 250mm
6. There must not be foreign body adhesion and the state of the surface must be excellent
7. Surface resistance $1 \times 10^5 \leq R_s < 1 \times 10^{11}$ OHMS
8. 17" PLASTIC-Reel
458-WSOP16-NT

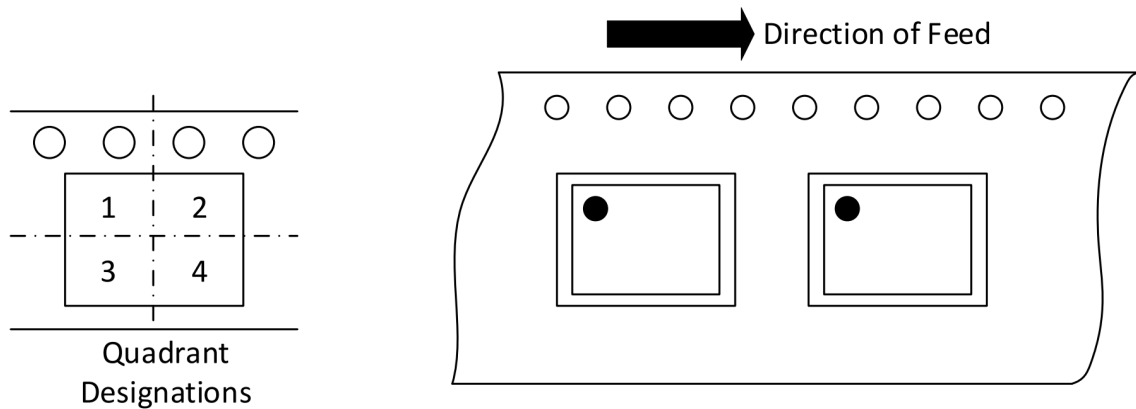


Figure 12.2 Tape Information of SOP16(300mil)/SOW16

Notes:

1. Material: Polystyrene (Black)
2. Flatness: Maximum Allowable: 3 mm
3. All dimensions are in millimeters.
4. Surface Resistance: 10^5 to 10^{11} OHMS/SQ.
5. All unspecified tolerances are: ± 0.25

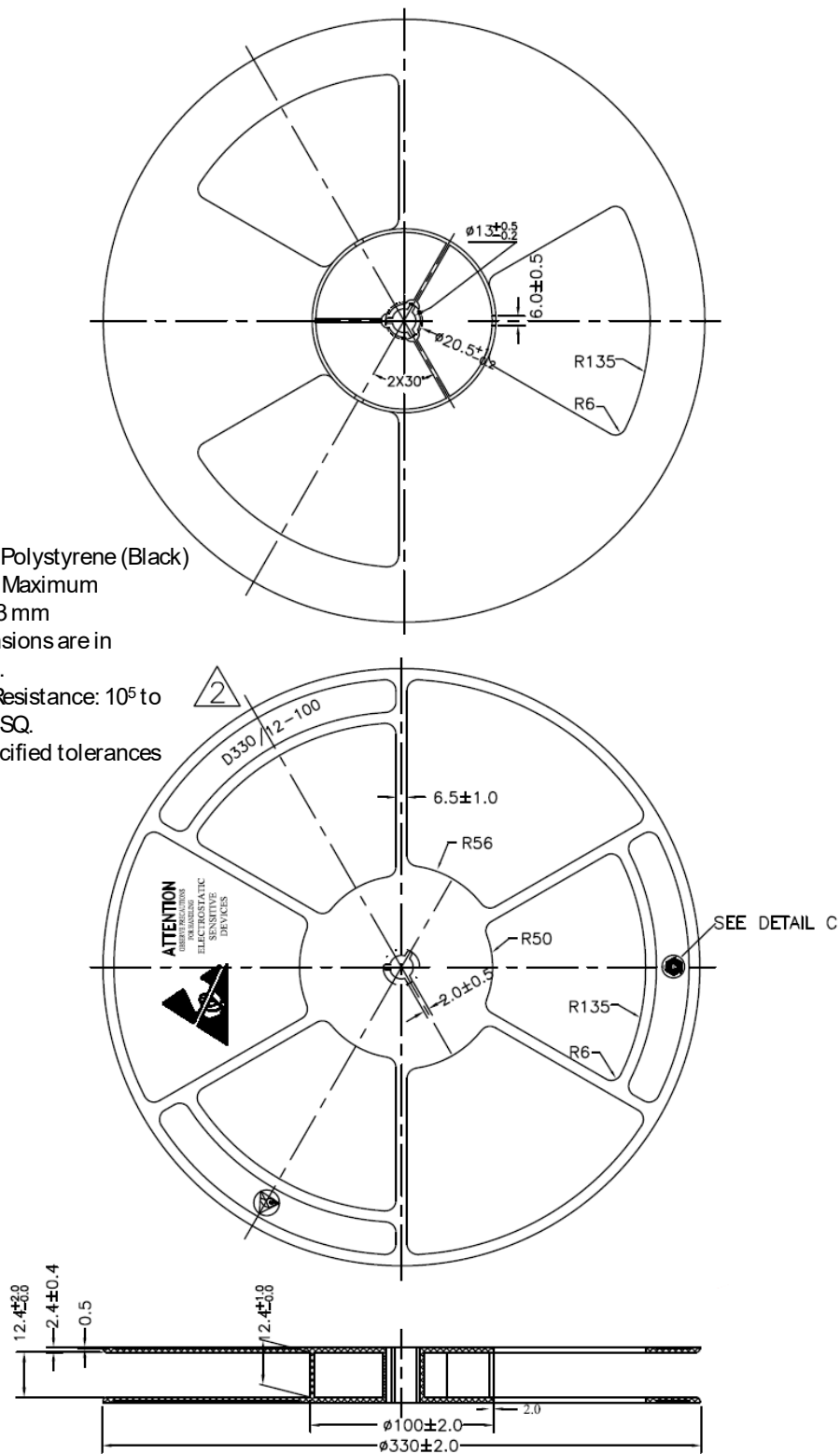
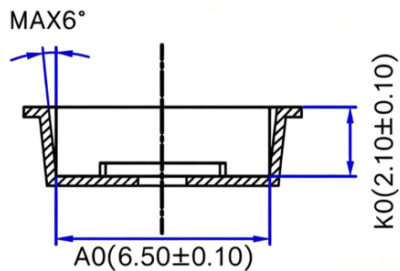
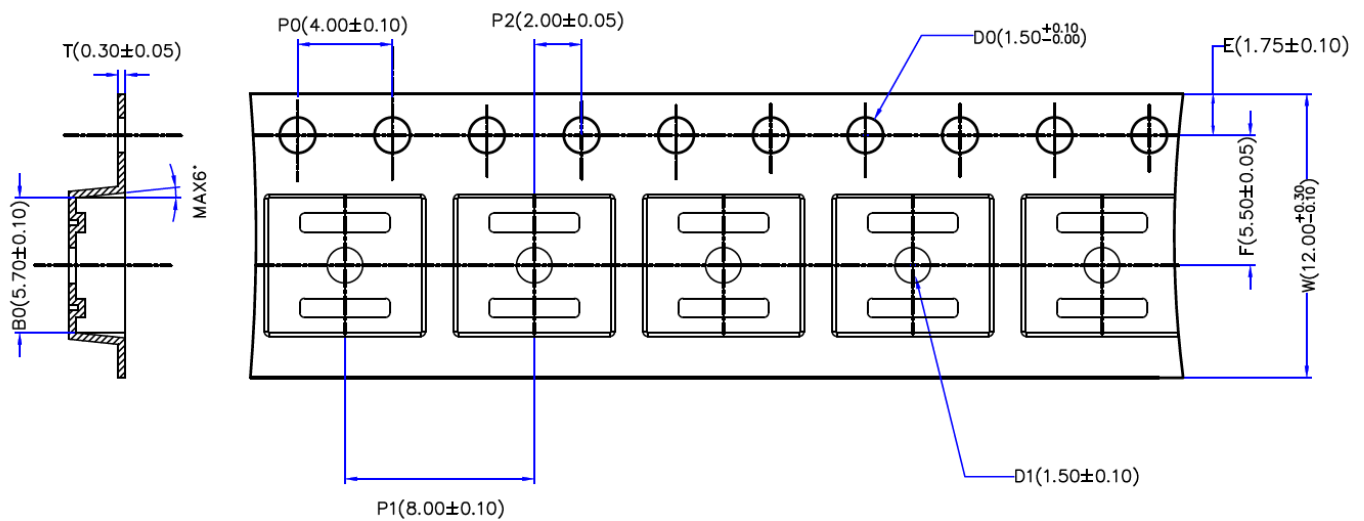


Figure 12.3 Reel Information of SSOP16(150mil)



NOTES:

1. ALL DIMS IN MM
2. MATERIAL: BLACK CONDUCTIVE PS
3. The other tolerance not indicated are $\pm 0.1\text{mm}$
4. 10 sprocket hole pitch cumulative tolerance $\pm 0.20\text{mm}$
5. Carrier camber is within 1mm in 250mm
6. There must not be foreign body adhesion and the state of the surface must be excellent
7. Surface resistance $1 \times 10^4 \leq R_s \leq 1 \times 10^9 \text{ OHMS}$
8. Friction Voltage $< 100\text{V}$
9. 17" PLASTIC-Reel

Figure 12.4 Tape Information of SSOP16(150mil)

13. Revision History

Revision	Description	Date
1.0	Initial version	2025/10/31
1.1	Add SSOP16 package information	2026/8/21

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