NOVOSENSE

SP301x
High Reliability Reinforced Digital Isolators for Isolated RS485
Datasheet (EN) 1.0

Product Overview

The SP301x devices are high reliability triple-channel digital isolators for isolated RS485. The SP301x devices are safety certified by UL1577 support 5kV$_{RMS}$ insulation withstand voltage, while providing high electromagnetic immunity and low emissions at low power consumption. The data rate of the Driver and Receiver channel is up to 8Mbps, and the common-mode transient immunity (CMTI) is up to 200kV/μs. The SP301x devices provide digital channel direction configuration and the default output level configuration when the input power is lost. Wide supply voltage of the SP301x devices support to connect with most digital interface directly, easy to do the level shift. High system level EMC performance enhance reliability and stability of use.

Key Features

- Up to 5000V$_{RMS}$ Insulation voltage
- Data rate of Driver and Receiver channel:
  – DC to 8Mbps
- Power supply voltage: 2.5V to 5.5V
- High CMTI: 200kV/μs
- Chip level ESD: HBM: ±8kV
- Robust Electromagnetic Compatibility (EMC)
  – System-Level ESD, EFT, and Surge Immunity
  – Low Emissions
- Isolation surge voltage: >10kV
- Default output state for RS-485 applications
- Low static power consumption: 1.13mA@3.3V
- Low propagation delay: <110ns
- Operation temperature: -40°C ~125°C
- RoHS-compliant package: SSOP10 (300mil)

Safety Regulatory Approvals

- UL recognition:
  - SSOP10(300mil): 5000V$_{RMS}$ for 1 minute per UL1577
- CQC certification per GB4943.1
- CSA component notice 5A
- DIN EN IEC 60747-17 (VDE 0884-17)

Applications

- Isolated RS485

Device Information

Part Number	*Package*	*Body Size*
SP301L-DSSWCR	SSOP10(300mil)	7.5mm × 4.1mm
SP301H-DSSWCR	SSOP10(300mil)	7.5mm × 4.1mm

Functional Block Diagrams

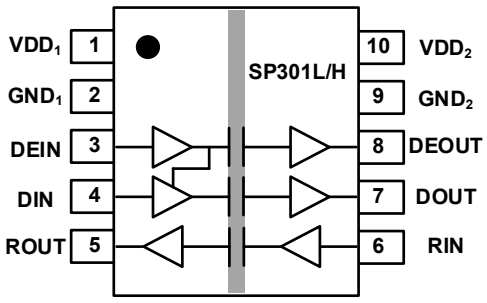

Figure 1.1 SP301L/ SP301H Block Diagram

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1. Pin Configuration and Functions

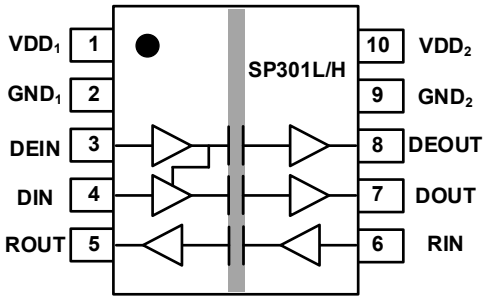


Figure 1.1 SP301L/SP301H Package

Table1.1 SP301L/SP301H Pin Configuration and Description

SP301x PIN NO.	SYMBOL	FUNCTION	Comment
1	VDD_1	Power Supply for Isolator Side 1	
2	GND_1	Ground 1, the ground reference for Isolator Side 1	
3	DEIN	Logic Input of Enable channel (Active High). When DEIN is high, the DOUT follows the same status with the DIN. When DEIN is low, the DOUT pin becomes independent of the DIN, the DOUT is forced to high.	Only for SP301L
		Logic Input of Enable channel (Active Low). When DEIN is low, the DOUT follows the same status with the DIN. When DEIN is high, the DOUT pin becomes independent of the DIN, the DOUT is forced to high.	Only for SP301H
4	DIN	Logic Input of Driver channel.	
5	ROUT	Logic Output of Receiver channel.	
6	RIN	Logic Input of Receiver channel.	
7	DOUT	Logic Output of Driver channel.	
8	DEOUT	Logic Output of Enable channel.	Only for SP301L
		Logic Output of Enable channel.	Only for SP301H
9	GND_2	Ground 2, the ground reference for Isolator Side 2	
10	VDD_2	Power Supply for Isolator Side 2	

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		6.5	V	VDD_1 to GND_1, VDD_2 to GND_2
Maximum Input Voltage	V_{DIN}, V_{DEIN}, V_{RIN}	-0.5		VDD_X (3) +0.5 (4)	V	
Maximum Output Voltage	V_{DOUT}, V_{DEOUT}, V_{ROUT}	-0.3		VDD_X (3) +0.5 (4)	V	
Output current	V_{DOUT}, V_{DEOUT}, V_{ROUT}	-10		10	mA	
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. 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) VDD_X is the side voltage power supply VDD, where X=1 or 2.

(4) Maximum voltage must not exceed 6.5 V.

3. ESD Ratings (1)

Parameters	Ratings	Value	Unit
Electrostatic discharge (ESD)	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 (2)	±8000	V
	Charged device model (CDM), per JEDEC specification JESD22-C101 (3)	±2000	V

(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	Comment
Power Supply Voltage	VDD_1	2.5		5.5	V	VDD_1 to GND_1
	VDD_2	2.5		5.5	V	VDD_2 to GND_2
High Level Input Voltage	VIH	0.7*VDD_X (1)			V	
Low Level Input Voltage	VIL			0.3*VDD_X (1)	V	
Data rate	DR			8	Mbps	D and R channel
Ambient Operating Temperature	T_A	-40		125	°C	

(1) VDD_X is the side voltage power supply VDD, where X=1 or 2.

5. Thermal Characteristics

Parameters	Symbol	SSOP10 (300mil)	Unit
Junction-to-ambient thermal resistance	$R_{\theta JA}$	106.7	°C /W
Junction-to-case(top) thermal resistance	$R_{\theta JC\ (top)}$	43.65	°C /W
Junction-to-board thermal resistance	$R_{\theta JB}$	50.6	°C /W
Junction-to-top characterization parameter	Ψ_{JT}	12.7	°C /W
Junction-to-board characterization parameter	Ψ_{JB}	48.2	°C /W

6. Specifications

6.1. Electrical Characteristics

(VDD_1=2.5V~5.5V, VDD_2=2.5V~5.5V, T_A=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD_1 = 5V, VDD_2 = 5V, T_A = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Power on Reset	VDD_{POR}	2	2.2	2.4	V	POR threshold as during power-up
	VDD_{HYS}		0.1		V	POR threshold Hysteresis
Rising input switching threshold	V_{IT+}		0.6*VDD_x(1)	0.7*VDD_x(1)	V	
Falling input switching threshold	V_{IT-}	0.3*VDD_x(1)	0.4*VDD_x(1)		V	
Input threshold voltage hysteresis	$V_{I(HYS)}$		0.2*VDD		V	
High Level Output Voltage	V_{OH}	VDD_x-0.2			V	I_{OH} ≤ 2mA
		VDD_x-0.1			V	I_{OH} ≤ 20μA
Low Level Output Voltage	V_{OL}			0.2	V	I_{OL} ≤ 2mA
				0.1	V	I_{OH} ≤ 20μA
Output Impedance	R_{out}		50		Ω	
Input Pull high or low Current	I_{pull}	-10		10	μA	
Start Up Time after POR	t_{rbs}		12	30	μs	
Common Mode Transient Immunity	CMTI	±150	±200		kV/μs	See Figure 6.9

(1) VDD_X is the side voltage power supply VDD, where X=1 or 2.

6.2. Supply Current Characteristics – 5V Supply

(VDD_1=5V± 10%, VDD_2=5V± 10%, T_A=-40°C to 125°C. Unless otherwise noted, Typical values are at **VDD_1 = 5V, VDD_2 = 5V,** T_A = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Supply current	I_{DD1}(Q0)		1.18	1.95	mA	Input is same with default input.
	I_{DD2}(Q0)		1.16	1.95	mA	
	I_{DD1}(Q1)		3.15	4.58	mA	Input is not same with default input.
	I_{DD2}(Q1)		3.22	4.82	mA	
	I_{DD1}(150k)		2.42	3.65	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 150kbps, C_L=15pF
	I_{DD2}(150k)		2.32	3.53	mA	
	I_{DD1}(1M)		2.49	3.73	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.42	3.61	mA	
	I_{DD1}(8M)		3.05	4.25	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 8Mbps, C_L=15pF
	I_{DD2}(8M)		3.02	4.04	mA	

6.3. Supply Current Characteristics –3.3V Supply

(VDD_1=3.3V± 10%, VDD_2=3.3V± 10%, T_A=-40°C to 125°C. Unless otherwise noted, Typical values are at **VDD_1 = 3.3V, VDD_2 = 3.3V,** T_A = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Supply current	I_{DD1}(Q0)		1.13	1.9	mA	Input is same with default input.
	I_{DD2}(Q0)		1.12	1.88	mA	
	I_{DD1}(Q1)		3.06	4.5	mA	Input is not same with default input.
	I_{DD2}(Q1)		3.15	4.73	mA	
	I_{DD1}(150k)		2.31	3.56	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 150kbps, C_L=15pF
	I_{DD2}(150k)		2.26	3.44	mA	
	I_{DD1}(1M)		2.37	3.62	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.32	3.50	mA	
	I_{DD1}(8M)		2.74	4.02	mA	DEIN=High for SP301L, DEIN=Low for SP301H,

Parameters	Symbol	Min	Typ	Max	Unit	Comments
	I_{DD2}(8M)		2.73	3.8	mA	DIN and RIN input with 8Mbps, C_L=15pF

6.4. Supply Current Characteristics–2.5V Supply

(VDD_1=2.5V± 10%, VDD_2=2.5V± 10%, T_A=-40°C to 125°C. Unless otherwise noted, Typical values are at **VDD_1 = 2.5V, VDD_2 = 2.5V,** T_A = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Supply current	I_{DD1}(Q0)		1.1	1.86	mA	Input is same with default input.
	I_{DD2}(Q0)		1.09	1.84	mA	
	I_{DD1}(Q1)		2.98	4.38	mA	Input is not same with default input.
	I_{DD2}(Q1)		3.09	4.61	mA	
	I_{DD1}(150k)		2.25	3.48	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 150kbps, C_L=15pF
	I_{DD2}(150k)		2.02	3.35	mA	
	I_{DD1}(1M)		2.29	3.53	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 1Mbps, C_L=15pF
	I_{DD2}(1M)		2.24	3.38	mA	
	I_{DD1}(8M)		2.59	3.84	mA	DEIN=High for SP301L, DEIN=Low for SP301H, DIN and RIN input with 8Mbps, C_L=15pF
	I_{DD2}(8M)		2.56	3.61	mA	

6.5. Switching Characteristics

(VDD_1=2.5V~5.5V, VDD_2=2.5V~5.5V, T_A=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD_1 = 5V, VDD_2 = 5V, T_A = 25°C)

Parameters	Symbol	Min	Typ	Max	Unit	Comments
Data Rate	DR	0		8	Mbps	Driver channel and Receiver channel
R Propagation Delay	t_{PLH}		20	35	ns	Receiver channel, see Figure 6.7
	t_{PHL}		20	35	ns	
Pulse Width Distortion $\|t_{PHL} - t_{PLH}\|$	PWD			10	ns	
D Propagation Delay	t_{PLH}		83	110	ns	

Parameters	Symbol	Min	Typ	Max	Unit	Comments
	t_{PHL}		83	110	ns	Driver channel, see Figure 6.7
Pulse Width Distortion $\|t_{PHL} - t_{PLH}\|$	PWD			10	ns	
Part-to-Part Delay Skew	t_{SK}(p2p)			5.0	ns	Driver and Receiver channel
DE Propagation Delay	t_{PLH}		129	200	ns	Enable channel, see Figure 6.7
	t_{PHL}		386	600	ns	
Enable Propagation Delay	t_{ELH}		46	100	ns	See Figure 6.8
	t_{EHL}		99	130	ns	
Rising Time	t_r			5.0	ns	See Figure 6.7 , C_L = 15pF
Falling Time	t_f			5.0	ns	See Figure 6.7 , C_L = 15pF

6.6. Typical Performance Characteristics

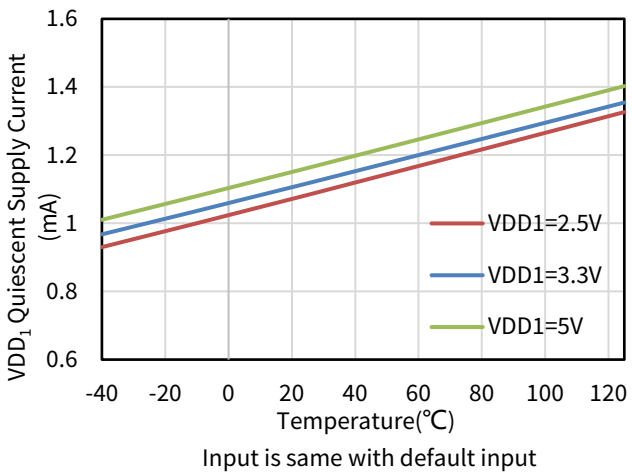


Figure 6.1. VDD_1 Quiescent Supply Current vs Temperature

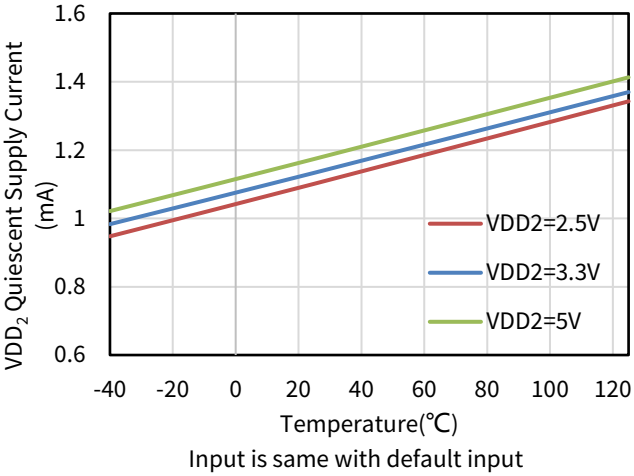


Figure 6.2. VDD_2 Quiescent Supply Current vs Temperature

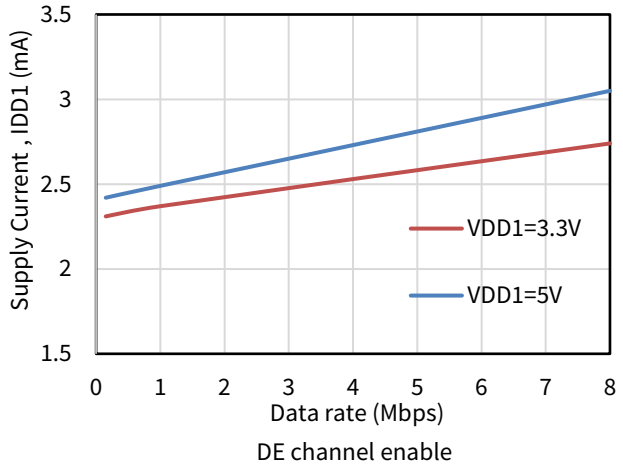


Figure 6.3. VDD_1 Supply Current vs Data Rate

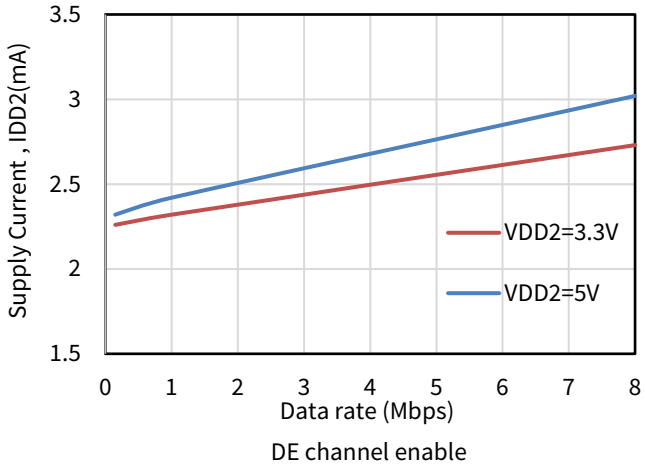


Figure 6.4. VDD_2 Supply Current vs Data Rate

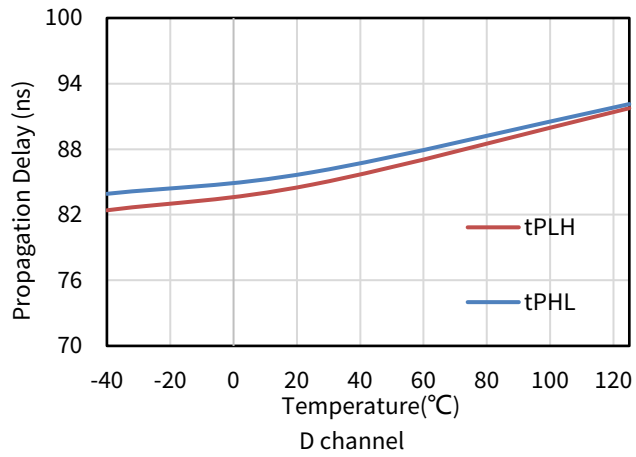


Figure 6.5. Propagation Delay of D channel Vs Temperature

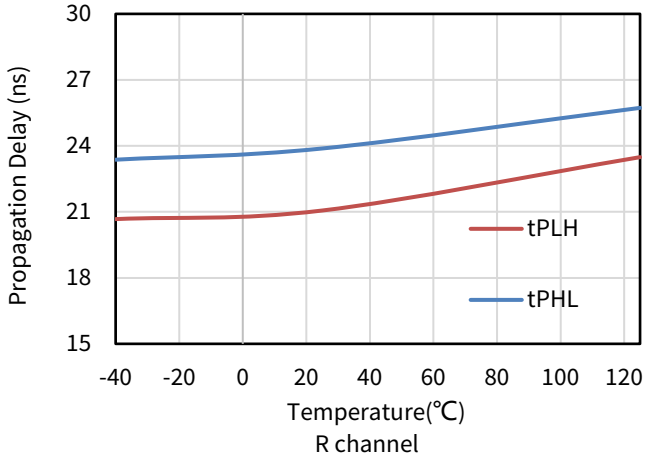
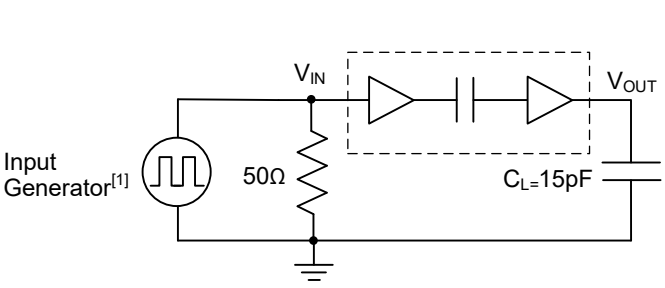
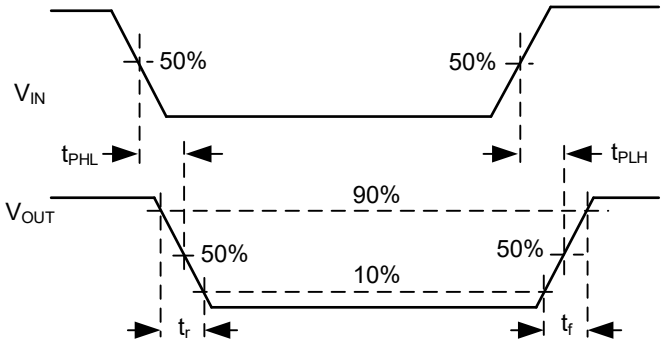


Figure 6.6. Propagation Delay of R channel Vs Temperature

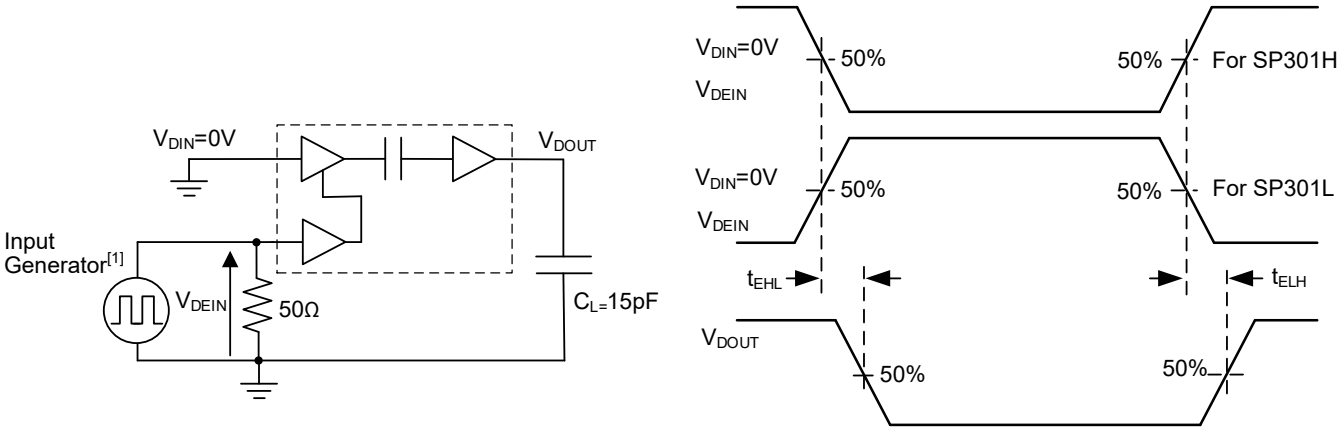
6.7. Parameter Measurement Information





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

Figure 6.7 Switching Characteristics Test Circuit and Waveform



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

Figure 6.8 Switching Characteristics Test Circuit and Waveform

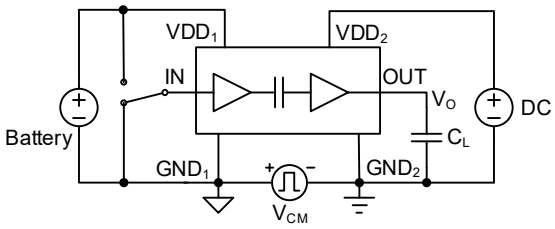


Figure 6.9 Common-Mode Transient Immunity Test Circuit

7. High Voltage Feature Description

7.1. Insulation and Safety Related Specifications

Parameters	*Symbol*	*Value SSOP10(300mil)*	*Unit*	*Comments*
Minimum External Clearance	CLR	8.0	mm	IEC 60664-1:2007
Minimum External Creepage	CPG	8.0	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 SSOP10(300mil)*
Overvoltage Category per IEC60664-1	For Rated Mains Voltage ≤ 150Vrms	I to IV
	For Rated Mains Voltage ≤ 300Vrms	I to IV
	For Rated Mains Voltage ≤ 600Vrms	I to IV
	For Rated Mains Voltage ≤ 1000Vrms	I to III
Climatic Classification		40/125/21
Pollution Degree per DIN VDE 0110,		2

7.2. Insulation Characteristics

Description	*Test Condition*	*Symbol*	*Value SSOP10(300mil)*	*Unit*
Maximum repetitive isolation voltage		V_{IORM}	2121	V_{PEAK}
Maximum Working Isolation Voltage	AC voltage	V_{IOWM}	1500	V_{RMS}
	DC voltage		2121	V_{DC}
Apparent Charge[1]	Method a, after Input/output safety test subgroup 2/3, $V_{ini}=V_{IOTM}$, t_{ini} = 60s, $V_{pd(m)}=1.2*V_{IORM}$, t_m=10s.	q_{pd}	<5	pC
	Method a, after environmental tests subgroup 1, $V_{ini}=V_{IOTM}$, t_{ini}=60s, $V_{pd(m)}=1.6*V_{IORM}$, t_m=10s			pC

	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 $V_{pd(m)}$=V_{ini}, t_m=t_{ini}(method b2)			pC
Maximum transient isolation voltage	t = 60 sec	V_{IOTM}	8000	V_{PEAK}
Maximum impulse voltage	Tested in air, 1.2/50-μs waveform per IEC62368-1	V_{IMP}	6250	V_{PEAK}
Maximum Surge Isolation Voltage [2]	Test method per IEC62368-1, 1.2/50μs waveform, V_{IOSM}≥V_{IMP} × 1.3	V_{IOSM}	10000	V_{PEAK}
Isolation Resistance [3]	V_{IO} =500V, T_A=25°C	R_{IO}	>10^{12}	Ω
	V_{IO} = 500V, 100 °C ≤ T_A ≤ 125°C		>10^{11}	Ω
	V_{IO} = 500V, at T_S=150°C		>10^{9}	Ω
Isolation Capacitance, input to output [3]	f = 1MHz	C_{IO}	0.5	pF
UL1577				
Withstand Isolation Voltage	V_{TEST} = V_{ISO}, t = 60s (qualification), V_{TEST} = 1.2 × V_{ISO}, t = 1 sec (100% production test)	V_{ISO}	5000	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.

[4] This coupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

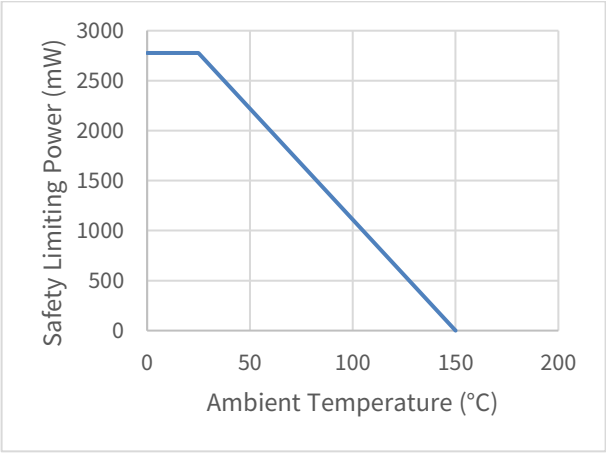
7.3. Safety-Limiting Values

Reinforce isolation safety-limiting values as outlined in VDE-0884-17 of SP301L-DSSWCR and SP301H-DSSWCR.

Parameter	*Description*	*Test Condition*	*Value*	*Unit*
P_S	Safety Supply Power	$R_{θJA}$ = 45 °C/W[1)], T_J = 150 °C, T_A = 25 °C	2777	mW
I_S	Safety Supply Current	$R_{θJA}$ = 45 °C/W[1)], V_I = 5.5V, T_J = 150 °C, T_A = 25 °C	505	mA
T_S	Safety Temperature [2]		150	°C

[1] Calculate with the junction-to-air thermal resistance, $R_{θJA}$, of SSOP10(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.



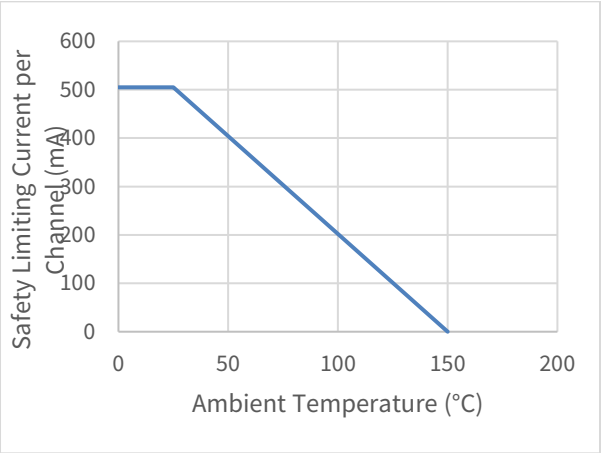


Figure 7.1 SP301L-DSSWCR and SP301H-DSSWCR Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN EN IEC 60747-17 (VDE 0884-17)

7.4. Regulatory Information

The SP301L-DSSWCR are approved 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, 5000V_{RMS} Isolation voltage	Single Protection, 5000V_{RMS} Isolation voltage	Reinforce Insulation V_{IORM}=2121Vpeak V_{IOTM}=8000Vpeak V_{IOSM}=10000Vpeak	Reinforce insulation	5000Vrms for 1min
File (pending)	File (pending)	File (pending)	File (pending)	File (pending)

The SP301H-DSSWCR are approved 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, 5000V_{RMS} Isolation voltage	Single Protection, 5000V_{RMS} Isolation voltage	Reinforce Insulation V_{IORM}=2121Vpeak V_{IOTM}=8000Vpeak V_{IOSM}=10000Vpeak	Reinforce insulation	5000Vrms for 1min
File (pending)	File (pending)	File (pending)	File (pending)	File (pending)

8. Function Description

8.1. Overview

The SP301x devices are Triple-channel digital isolators based on a capacitive isolation barrier technique. The digital signal is modulated with RF carrier generated by the internal oscillator at the Transmitter side. Then it is transferred through the capacitive isolation barrier and demodulated at the Receiver side.

The SP301x devices are high reliability triple -channel digital isolators for isolated RS485. The SP301x 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 data rate of the SP301x is up to 8Mbps, and the common-mode transient immunity (CMTI) is up to 200kV/us. The SP301x devices provide digital channel direction configuration and the default output level configuration when the input power is lost. Wide supply voltage of the SP301x device support to connect with most digital interface directly, easy to do the level shift. High system level EMC performance enhance reliability and stability of use.

The SP301x have a default output status when VDDIN is unready and VDDOUT is ready as shown in Table 8.1, Table 8.2 and Table 8.3, which helps for diagnosis when power is missing at the transmitter side.

Table 8.1 Device Features

Part Number	*CHANNEL DIRECTION*	*DEFAULT OUTPUT*			*Enable Voltage of DE*
		DE Channel	*D Channel*	*R Channel*	
SP301L	2 Forward 1 Reverse	Low	High	High	High
SP301H	2 Forward 1 Reverse	High	High	High	Low

Table 8.2 Forward Channel Status and Function Table

Part Number	*VDD$_1$*	*VDD$_2$*	*DEIN*	*DIN*	*DEOUT*	*DOUT*	*Comment*
SP301L	Ready	Ready	H	H or Open	H	H	Normal operation. DOUT follows the same status with the input of DIN
	Ready	Ready	H	L	H	L	
	Ready	Ready	L or Open	X	L	H	DOUT Disabled, DOUT is high level
	Unready	Ready	X	X	L	H	
	Ready	Unready	X	X	Undetermined		
SP301H	Ready	Ready	L	H or Open	L	H	Normal operation. DOUT follows the same status with the input of DIN
	Ready	Ready	L	L	L	L	
	Ready	Ready	H or Open	X	H	H	DOUT Disabled, DOUT is high level
	Unready	Ready	X	X	H	H	
	Ready	Unready	X	X	Undetermined		
	Note: H=Logic high; L=Logic low; X=Logic low or logic high There is a protection diode between the input and the VDD. When the VDD is floating, the strong drive signal through the input pin will put the VDD in an indeterminate state.						

Table 8.3 Reverse Channel Status and Function Table

VDD1	VDD2	RIN	ROUT	Comment
Ready	Ready	H or NC	H	Normal operation.
Ready	Ready	L	L	
Unready	Ready	X	Undetermined	The ROUT follows the same status with the input after VDD_2 is powered on.
Ready	Unready	X	H	The ROUT follows the same status with the input after VDD_1 is powered on.
Note: H=Logic high; L=Logic low; X=Logic low or logic high There is a protection diode between the input and the VDD. When the VDD is floating, the strong drive signal through the input pin will put the VDD in an indeterminate state.				

8.2. OOK Modulation

SP301x are based on a capacitive isolation barrier technique and the digital signal is modulated with RF carrier generated by the internal oscillator at the transmitter side, as shown in Figure 8.1, then it is transferred through the capacitive isolation barrier and demodulated at the receiver side. The modulation uses OOK modulation technique with key benefits of high noise immunity and low radiation EMI.

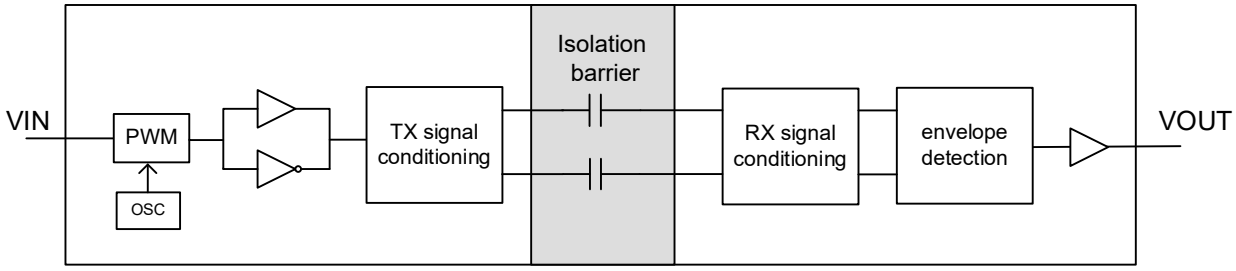


Figure8.1 Single Channel Function Block Diagram

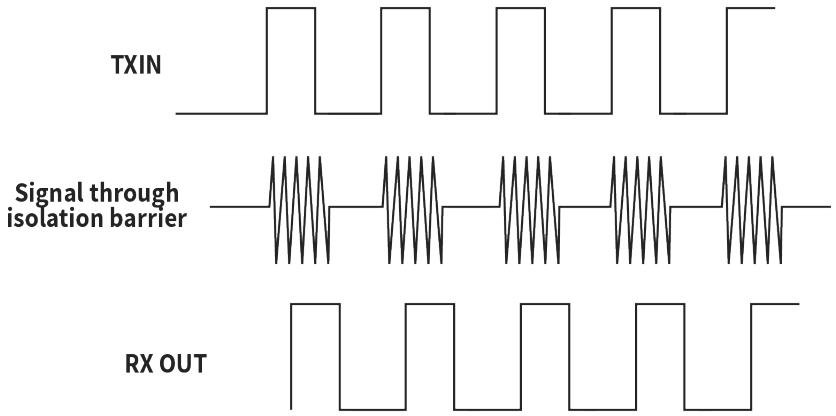


Figure 8.2 OOK Modulation

9. Application Note

9.1. Layout considerations

The SP301x requires a 0.1 μF bypass capacitor between VDD_1 and GND_1, VDD_2 and GND_2. The capacitor should be placed as close to the supply pins as possible. The recommended PCB layout is detailed in Figure 9.1. It is critical to keep the area under the IC free of any planes, traces, pads, or vias.

For designs operating in excessively noisy environments, it is recommended to include 50 Ω to 300 Ω series resistors on the input and output (I/O) pins. This not only suppresses noise but also enhances system reliability by improving latch-up immunity.

The isolator's driver output impedance is typically 50 Ω with a ±40% tolerance. When driving loads that are sensitive to transmission line effects, the output traces must be designed with controlled impedance and appropriate termination schemes.

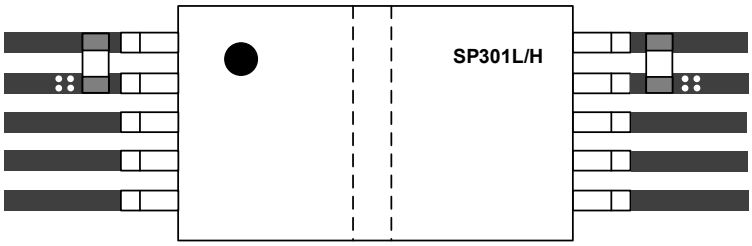


Figure 9.1 PCB Layout Example

9.2. Typical Application Circuit

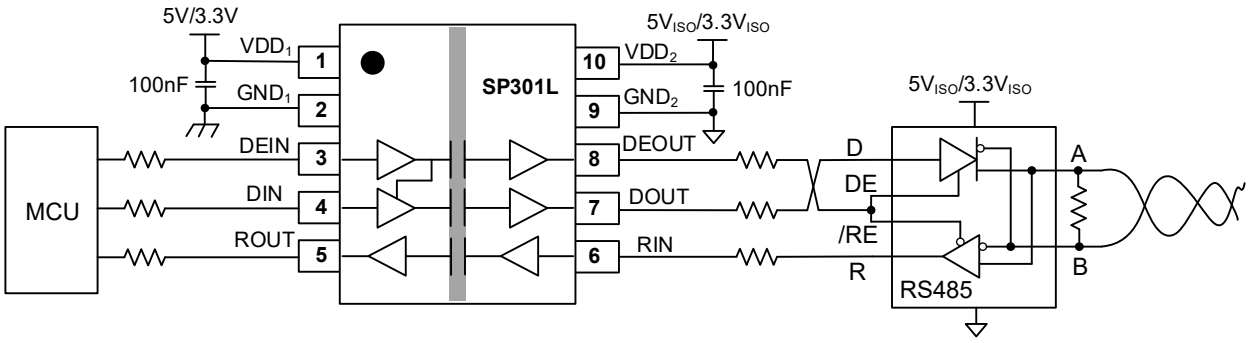
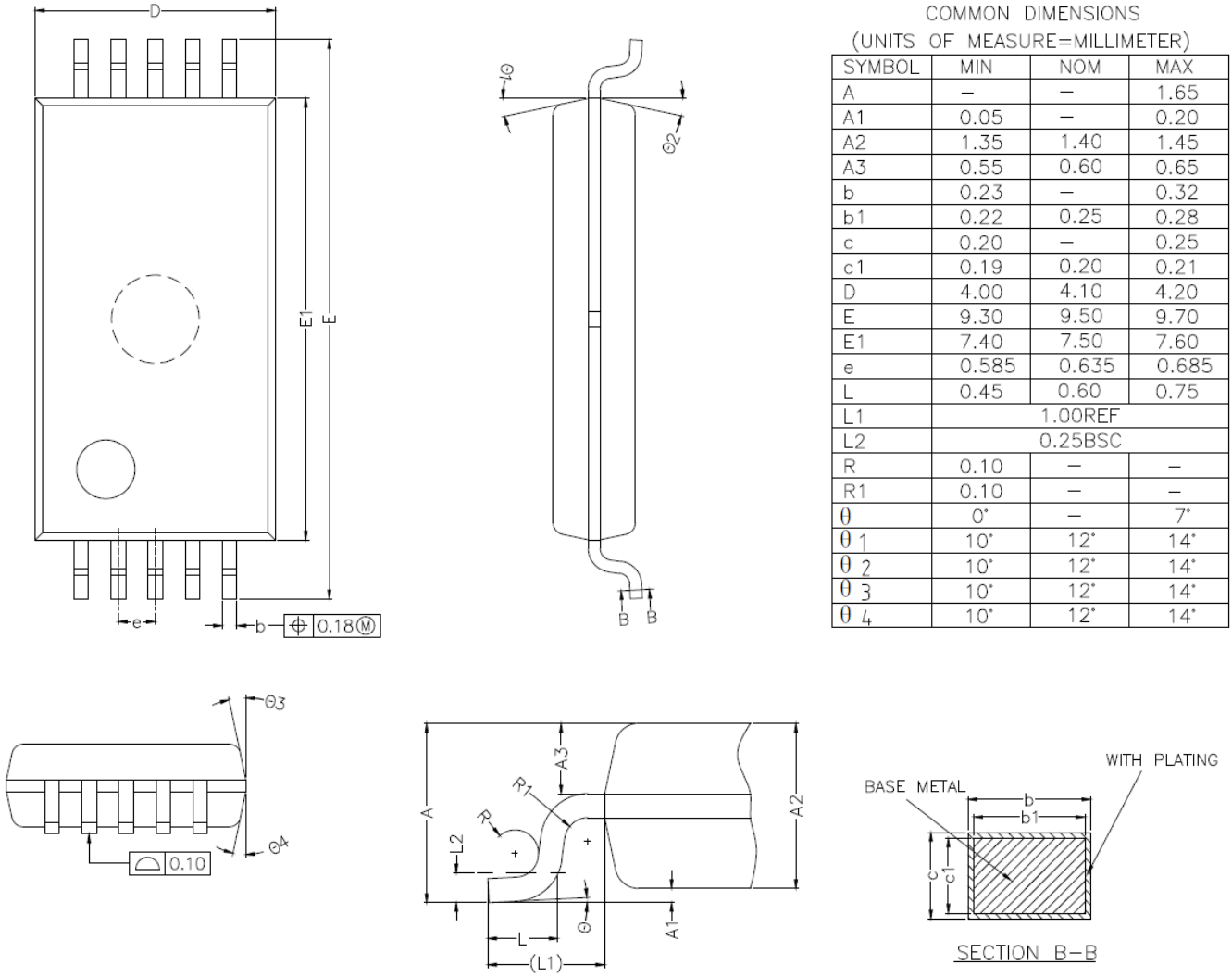


Figure 9.2 Simplified Applications Circuit for ISO 485 Interface

10. Package Information

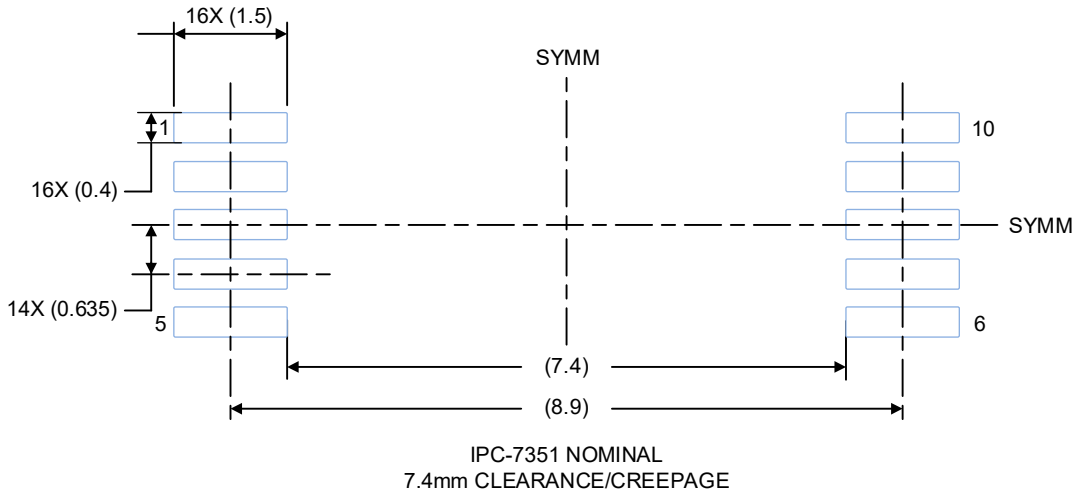


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

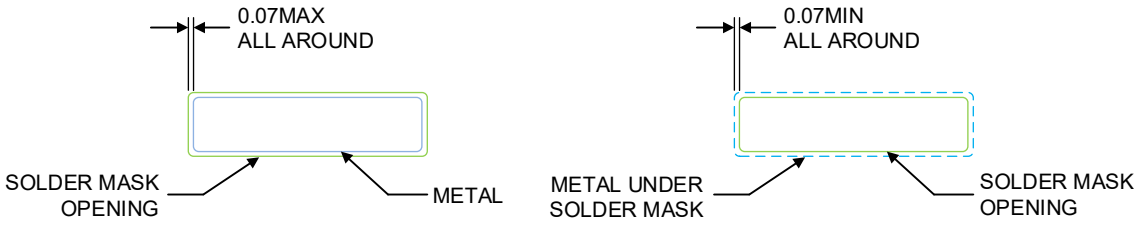
SYMBOL	MIN	NOM	MAX
A	–	–	1.65
A1	0.05	–	0.20
A2	1.35	1.40	1.45
A3	0.55	0.60	0.65
b	0.23	–	0.32
b1	0.22	0.25	0.28
c	0.20	–	0.25
c1	0.19	0.20	0.21
D	4.00	4.10	4.20
E	9.30	9.50	9.70
E1	7.40	7.50	7.60
e	0.585	0.635	0.685
L	0.45	0.60	0.75
L1	1.00REF		
L2	0.25BSC		
R	0.10	–	–
R1	0.10	–	–
θ	0°	–	7°
θ 1	10°	12°	14°
θ 2	10°	12°	14°
θ 3	10°	12°	14°
θ 4	10°	12°	14°

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 SSOP10(300mil) /SSOW10 Package Shape and Dimension in millimeters



LAND PATTERN EXAMPLE (mm)



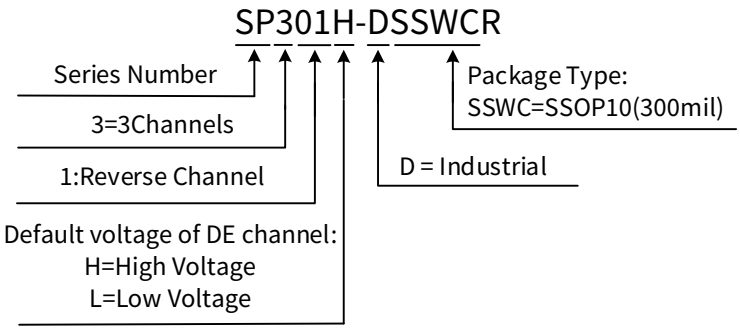
SOLDER MASK DETAILS

Figure 10.2 SSOP10(300mil)/SSOW10 Package Board Layout Example

11. Order Information

Part Number	Isolation Rating (kV)	Default Voltage of DE	Max Data Rate (Mbps)	Temperature	MSL	Package Type	Package Drawing	SPQ
SP301L-DSSWCR	5	Low	8	-40 to 125℃	3	SSOP10 (300mil)	SSOW10	4000
SP301H-DSSWCR	5	High	8	-40 to 125℃	3	SSOP10 (300mil)	SSOW10	4000

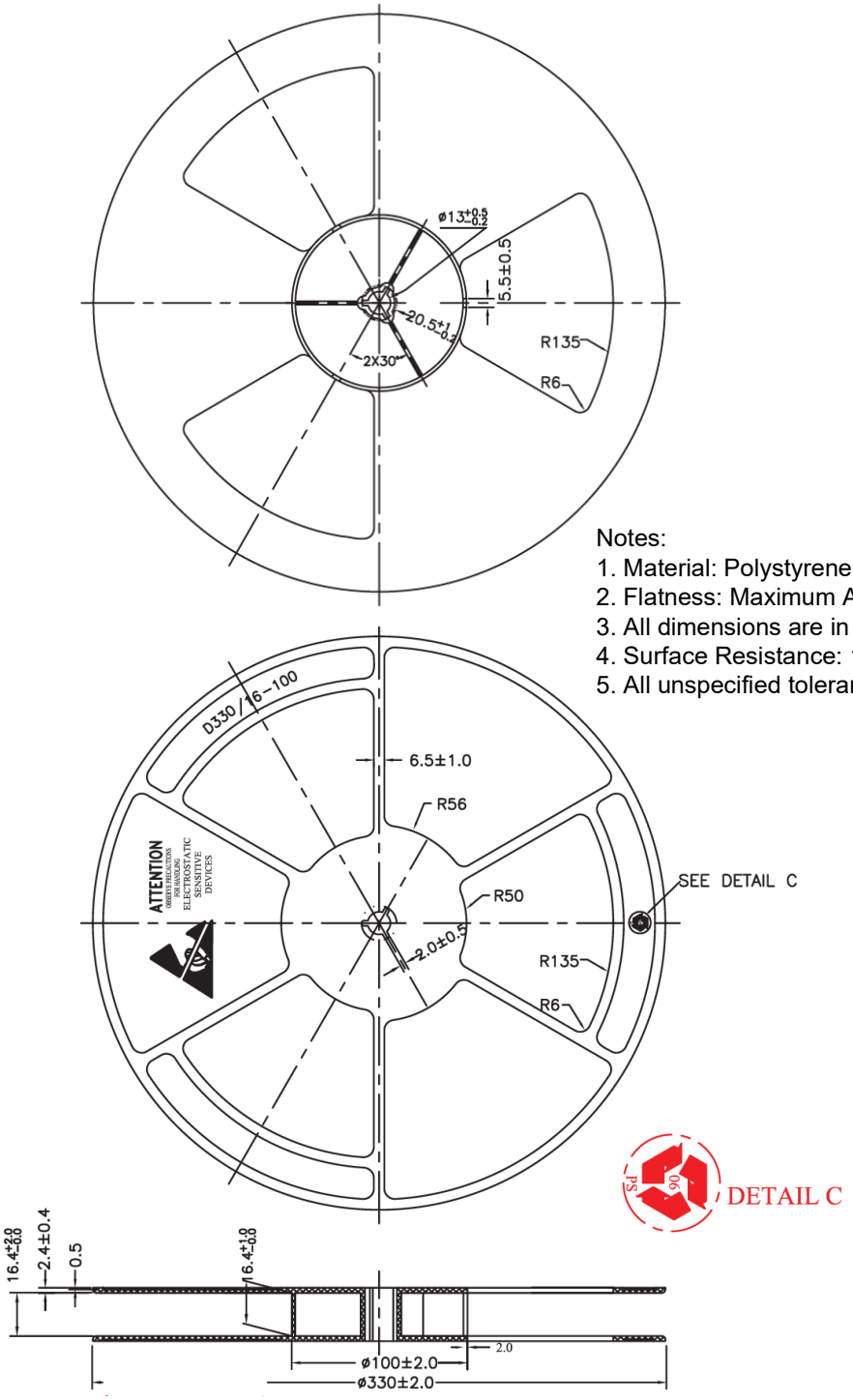
Part Number Rule:



12. Documentation Support

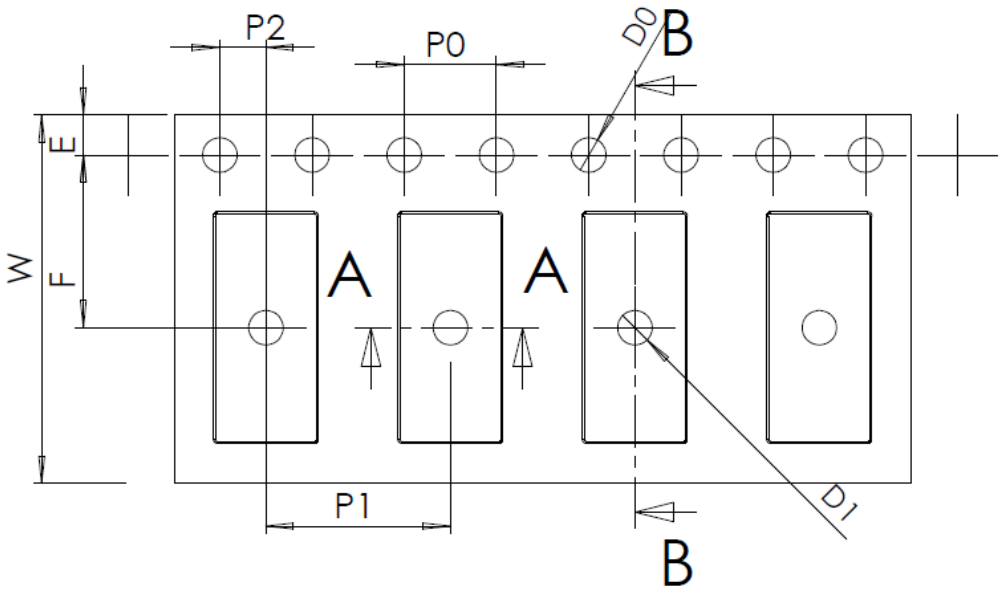
Part Number	*Product Folder*	*Datasheet*	*Technical Documents*	*Isolator selection guide*
SP301L-DSSWCR	tbd	tbd	tbd	tbd
SP301H-DSSWCR	tbd	tbd	tbd	tbd

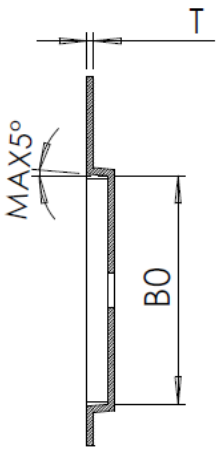
13. Tape and Reel Information



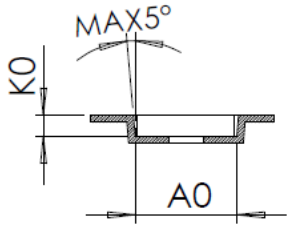
Notes:
1. Material: Polystyrene (Black)
2. Flatness: Maximum Allowable: 3 mm
3. All dimensions are in millimeters.
4. Surface Resistance: 10^5 to 10^{11} OHMS/SQ.
5. All unspecified tolerances are: ±0.25

Figure 13.1 Reel Information of SSOP10(300mil)





Section B-B
Scale 3:1



Section A-A
Scale 3:1

NOTES:
1、10spockets hole pitch cumulative tolerance ±0.2mm
2、Carrier camber is within 1mm in 250mm
3、Material: black cinductive PS
4、All dims in: mm
5、There must not be foreign body adhesion and the state of the surface must be excellent
6、Surface resistance 1x10E4Ω≤R<1X10E9Ω
7、Friction voltage<100V

Item	Spec
W	16.00+0.30/-0.10
E	1.75±0.10
F	7.50±0.10
P0	4.00±0.10
P1	8.00±0.10
P2	2.00±0.10
D0	1.50+0.10/0
D1	1.50±0.10
A0	4.40±0.10
B0	9.90±0.10
K0	1.80±0.10
T	0.30±0.05
Unit	mm

Figure 13.2 Tape Information of SSOP10(300mil)

14. Revision History

Revision	Description	Date
1.0	Initial version	2025/11/11

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