characteristic

- 3.0~5.5V Power supply range, half-duplex;
- The contact discharge capacity of the total terminal port is above 15kV
- The total line fault tolerance and pressure resistance reach ±15V
- Driver short circuit output protection;
- Over temperature protection function;
- Low power consumption shutdown function;
- Receiver open circuit failure protection;
- Strong anti-noise ability;
- Integrated transient voltage resistance function;
- The data transmission rate in the electrical noise environment can reach 16Mbps.

Schematic diagram of product appearance

Provide green and lead-free packaging

description

SIT65176B is an RS-485 transceiver powered by a 3.0V~5V power supply, with bus port contact discharge capability of more than 15kV, bus voltage range of ±15V, half-duplex, low power consumption, and fully meets the requirements of TIA/EIA-485 standard.

SIT65176B Includes a driver and a receiver, both of which can be enabled and disabled independently. When both are disabled, the driver and receiver output high impedance state. Up to 16Mbps error-free data transmission is possible.

SIT65176B The working voltage range is 3.0~5.5V, and it has fail-safe (fail-safe), over temperature protection, current limiting protection, over voltage protection and other functions.

Pin distribution diagram

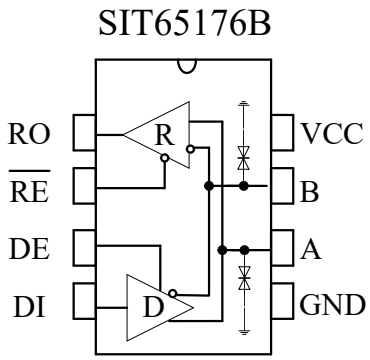


Figure 1 SIT65176B Pin distribution diagram

Pin definition

Pin number	Pin name	Pin function
1	RO	Receiver output end. When /RE is low, if A-B is greater than or equal to-10 mV, RO output is high; if A-B is less than or equal to-200mV, RO output is low.
2	/RE	Receiver output enable control. When /RE is connected to low voltage, the receiver output enables and RO output is valid; when /RE is connected to high voltage, the receiver output is disabled and RO is in high resistance state; When RE is connected to a high level and DE is connected to a low level, the device enters a low-power shutdown mode.
3	DE	Driver output enable control. When DE is high, the driver output is valid; when DE is low, the output is high resistance state; When the RE is connected to a high level and the DE is connected to a low level, the device enters a low-power shutdown mode.
4	DI	DI driver input. When DE is high, the low level on DI makes the in-phase terminal A of the driver output low and the out-of-phase terminal B of the driver output high; the high level on DI will make the in-phase terminal output high and the out-of-phase terminal output low.
5	GND	Landing.
6	A	Receiver in-phase input and driver in-phase output.
7	B	Receiver inverting input and driver inverting output.
8	VCC	Power connection.

absolute rating

Parameter	Symbol	Big or small	Unit
Supply voltage	VCC	+7	V
Control the port voltage	/RE，DE，DI	-0.3~VCC+0.5	V
Total input voltage on the bus	A，B	-15~+15	V
Receiver output voltage	RO	-0.3~VCC+0.5	V
Operating temperature range	T_A	-40~85	℃
Storage temperature range	T_{stg}	-60~150	℃
Welding temperature range		300	℃

Continuous power consumption	SOP8	470	mW
	MSOP8	830	mW
	DIP8	700	mW

The maximum limit parameter value is the value beyond which the device may suffer irrecoverable damage. Under these conditions, it is not conducive to the normal operation of the device. Continuous operation of the device at the maximum allowable rating may affect the reliability of the device. All voltage reference points are ground.

DC electrical characteristics of the driver

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Driver differential output (non-loaded)	V_{OD1}		2.5		5.5	V
Drive differential output	V_{OD2}	Graph 2,RL=54Ω, VCC=3.3V	1.5	1.8	VCC	V
		Graph 2,RL=54Ω, VCC=5V	1.5	3	VCC	
Change in the amplitude of the output voltage (NOTE1)	ΔV_{OD}	Graph 2,RL=54Ω			0.2	V
Output common mode voltage	V_{OC}	Graph 2,RL=54Ω			3	V
Change in amplitude of common-mode output voltage (NOTE1)	ΔV_{OC}	Graph 2,RL=54Ω			0.2	V
High-level input	V_{IH}	DE, DI, /RE	2.0			V
Low level input	V_{IL}	DE, DI, /RE			0.8	V
Logic input current	I_{IN1}	DE, DI, /RE	-2		2	μA
The current at the output short circuit is high	I_{OSD1}	Short circuit to 0V~12V			250	mA
The current at the time of output short circuit is low	I_{OSD2}	Short circuit to-7V~0V	-250			mA
Overtemperature shutdown threshold temperature				140		℃
Overtemperature shutdown hysteresis temperature				20		℃

(If no other description is given, Temp=TMIN~TMAX, Temp=25 , VCC=5V.)

Note1: VOD and VOC are the changes in VOD and VOC amplitude caused by the state change of input signal DI.

DC electrical characteristics of the receiver

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Input current (A, B)	I_{IN2}	DE=0V, VCC=0 or 5V V_{IN}=12V			125	μA
		DE=0V,	-100			μA

		VCC=0 or 5V V_{IN}=-7V				
Positive input threshold voltage	V_{IT+}	-7V≤V_{CM}≤12V			-10	mV
Reverse input threshold voltage	V_{IT-}	-7V≤V_{CM}≤12V	-200			mV
Input hysteresis voltage	V_{hys}	-7V≤V_{CM}≤12V	10	30		mV
High level output voltage	V_{OH}	I_{OUT}=−2.5mA， V_{ID}=+200mV	VCC-1.5			V

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Low level output voltage	V_{OL}	I_{OUT}=+2.5mA, V_{ID}=-200 mV			0.4	V
Three-state input leakage current	I_{OZR}	0.4 V<V_O< 2.4V			±1	μA
Input resistance at the receiver	R_{IN}	-7V≤V_{CM}≤12V	96			kΩ
Receiver short circuit current	I_{OSR}	0 V≤V_O≤VCC	±8		±90	mA

(If not otherwise stated, Temp=TMIN~TMAX, Temp=25 .)

supply current

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Supply current	I_{CC1}	/RE=0V, DE=0V, VCC=3.3V		240	650	μA
		/RE=0V, DE=0 V VCC=5V		270	750	μA
	I_{CC2}	/RE=VCC, DE=VCC, VCC=3.3V		250	650	μA
		/RE=0V, DE=0V, VCC=5V		280	750	μA
Shut off the current	I_{SHDN}	/RE=VCC,DE=0V, VCC=3.3V		0.2	10	μA
		/RE=VCC,DE=0 V, VCC=5V		0.2	10	μA

Driver switch characteristics

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Driver differential output delay	t_{DD}	RL=60Ω, CL =100 pF, see Figure 3 and Figure 4		15	32	ns
Drive differential output transition time	t_{TD}			8	20	ns
Driver propagation delay From low to high	t_{PLH}	R_L=27Ω, See Figure 3 and Figure 4		18	40	ns
Driver propagation delay From high to low	t_{PHL}			18	40	ns
$\|t_{PLH}-t_{PHL}\|$	t_{PDS}			2	6	ns
Enable to output high	t_{PZH}	R_L=110Ω, See Figure 5			55	ns
	t_{PZL}				55	ns

Enable to output low		and Figure 6				
Input is low to the forbidden energy	t_{PLZ}	R_L=110Ω, See Figure 5 and Figure 6			85	ns
Input high enough to disable energy	t_{PHZ}				85	ns

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Under shutdown conditions, Enable to output high	t_{DSH}	R_L=110Ω, See Figure 5 and Figure 6		20	100	ns
Under shutdown conditions, Enable to output low	t_{DSL}	R_L=110Ω, See Figure 5 and Figure 6		20	100	ns

Receiver switch characteristics

Parameter	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Acceptor The propagation delay from input to output increases from low to high	t_{RPLH}	C_L=15pF, See Figure 7 and Figure 8		40	70	ns
Acceptor The input to output propagation delay goes from high to low	t_{RPHL}			40	70	ns
$\|t_{RPLH} - t_{RPHL}\|$	t_{RPDS}			3	8	ns
Enable to output low time	t_{RPZL}	C_L=15pF, See Figure 7 and Figure 8		15	40	ns
Enable the high time to output	t_{RPZH}	C_L=15pF, See Figure 7 and Figure 8		15	40	ns
From low output to forbidden time	t_{RPLZ}	C_L=15pF, See Figure 7 and Figure 8		25	55	ns
From high output to forbidden time	t_{RPHZ}	C_L=15pF, See Figure 7 and Figure 8		25	55	ns
In the off state Enable the high time to output	t_{RPSH}	C_L=15pF, See Figure 7 and Figure 8		150	500	ns
In the off state Enable to output low time	t_{RPSL}	C_L=15pF, See Figure 7 and Figure 8		150	500	ns
Enter the shutdown state time	t_{SHDN}	NOTE2	50		300	ns

Note2: When /RE=1 and DE=0, the duration is less than 80ns, the device must not enter the shutdown state; when it is greater than 300ns, the device must enter the shutdown state.

Send function table

Control		Import	Output	
/RE	DE	DI	A	B
X	1	1	H	L
X	1	0	L	H
0	0	X	Z	Z
1	0	X	Z(shutdown)	
X: any level; Z: high resistance.				

Receive function table

Control		Import	Output
/RE	DE	A-B	RO
0	X	≥-10mV	H
0	X	≤-200mV	L
0	X	Open/ circuit	H
1	X	X	Z
X: any level; Z: high resistance.			

test circuit

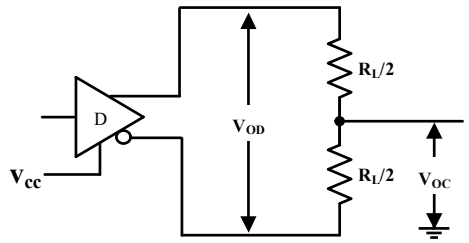
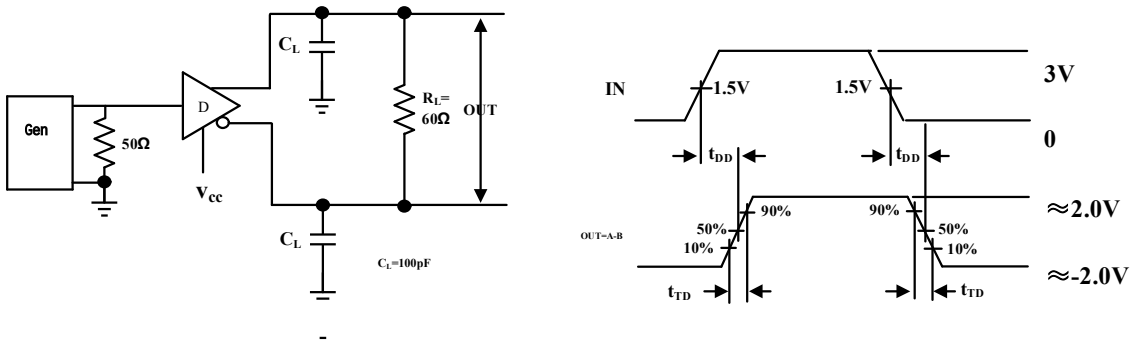


Figure 2 DC test load for the driver



CL contains probes and stray capacitance (same below)

Figure 3 Driver differential delay and transit time

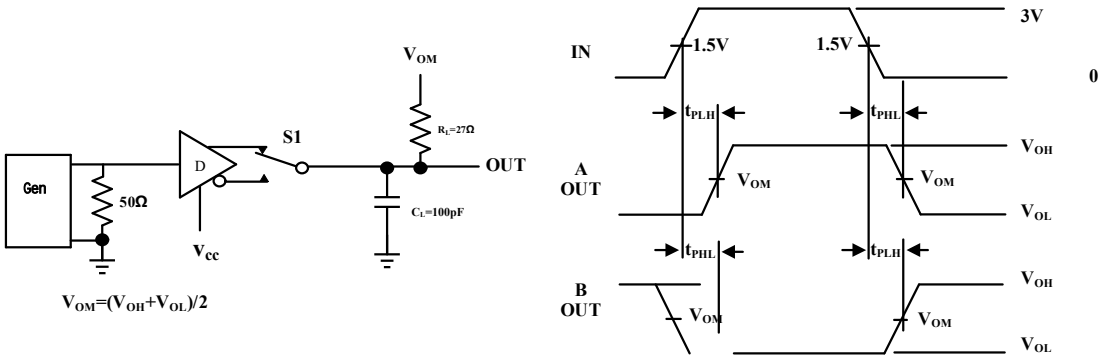


Figure 4 Driver propagation delay

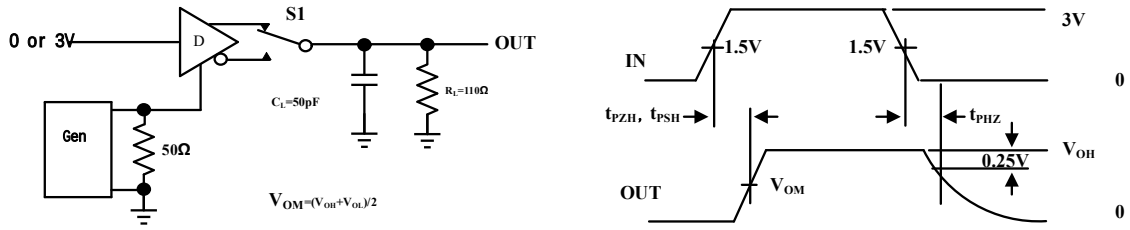


Figure 5 Driver enable and disable time

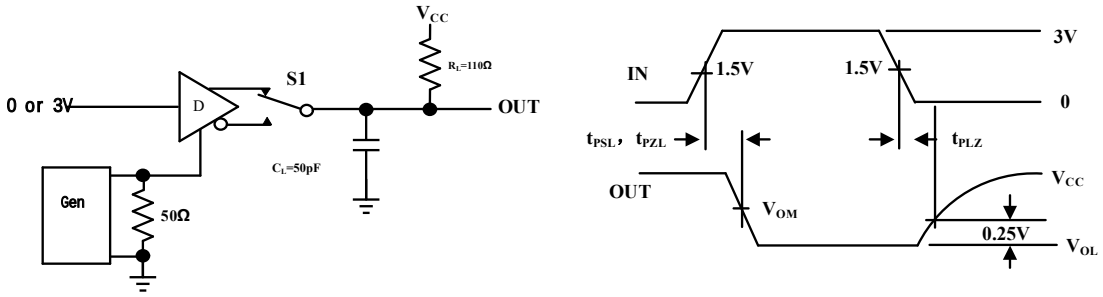


Figure 6 Driver enable and disable time

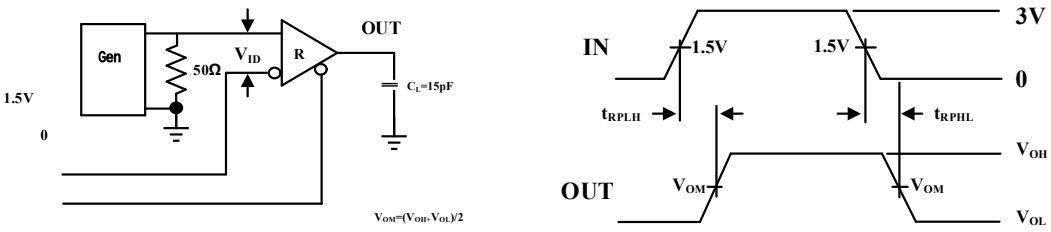
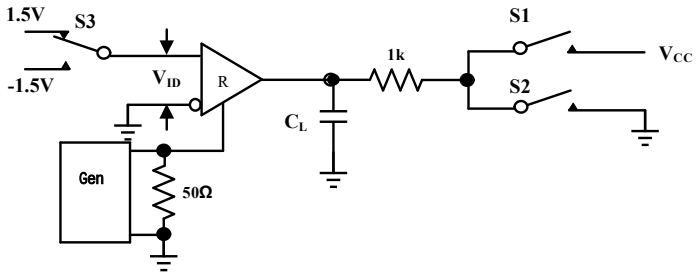


Figure 7 Receiver propagation delay test circuit



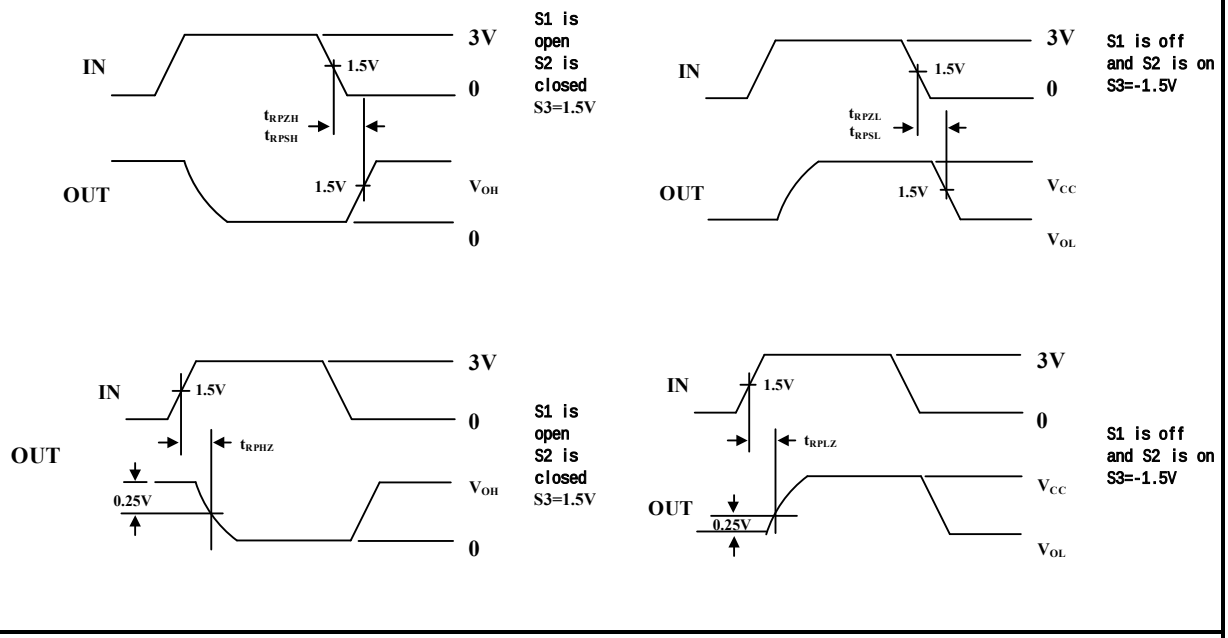


Figure 8 Receiver enable and disable time

1 resume

The SIT65176B is a half-duplex high-speed transceiver powered by a 3.0V~5.5V power supply, with bus port contact discharge capability exceeding 15kV and bus DC withstand voltage reaching over ±15V. It is used for RS-485/RS-422 communication and includes a driver and receiver. The SIT65176B features fail-safe, overvoltage protection, overcurrent protection, and overheating protection. It achieves error-free data transmission at up to 16Mbps.

2 Driver output protection

To prevent excessive output current and high power consumption caused by faults or bus conflicts, two mechanisms are employed. First, overcurrent protection, which provides rapid short-circuit protection across the entire common-mode voltage range (refer to typical operating characteristics). Second, a thermal shutdown circuit that forces the driver output into a high-impedance state when the die temperature exceeds 140 .

3 Typical application

3.1 Bus topology networking: SIT65176B RS485 Transceivers are designed for bidirectional data communication on multi-drop bus transmission lines. Figure 9 shows a typical network application circuit. These devices can also be used as linear repeaters when the cable length exceeds 4000 feet. To reduce reflections, termination matching at both ends of the transmission line should be performed with their characteristic impedance, and branch connections outside the main trunk should be as short as possible.

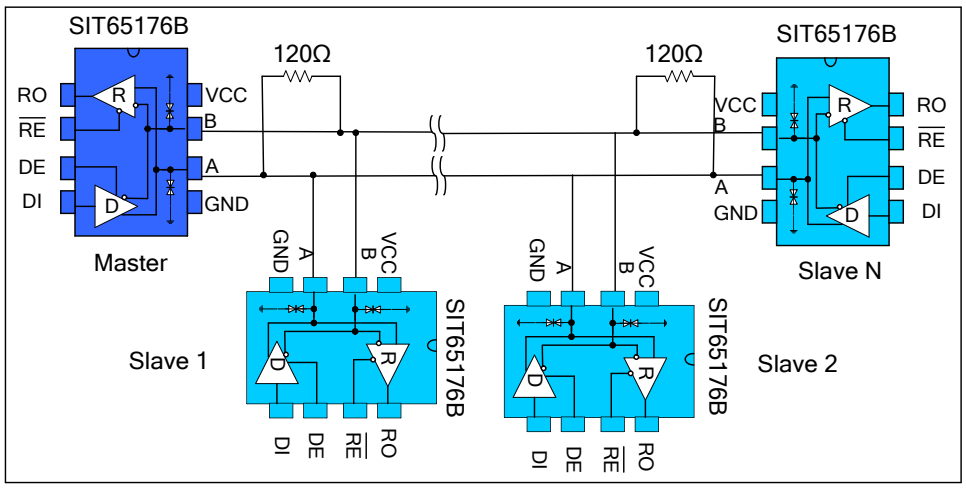


Figure 9 Bus type RS485 half-duplex communication network

3.2 Hand-in-hand networking: Also known as the daisy chain topology, it is the standard and specification for RS485 bus cabling, recommended by organizations such as TIA for RS485 bus topologies. The wiring method involves forming hand-in-hand connections between the master control device and multiple slave devices, as shown in Figure 10. This method does not leave any branches, which is what defines a hand-in-hand connection. This wiring method has advantages such as minimal signal reflection and high communication success rates.

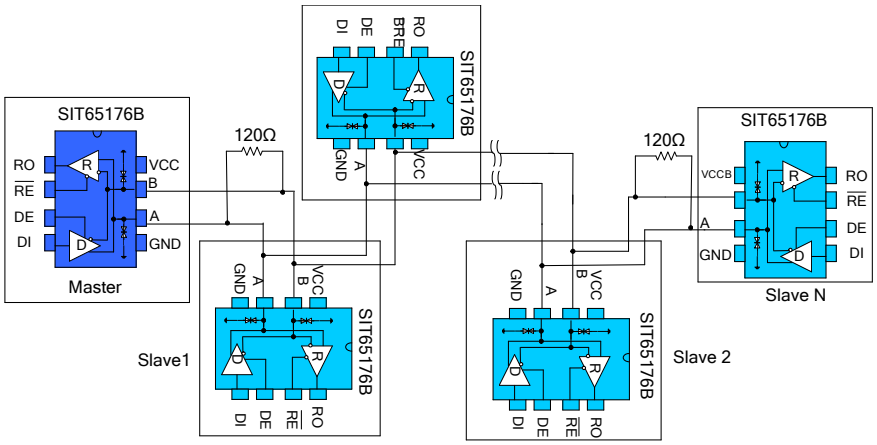
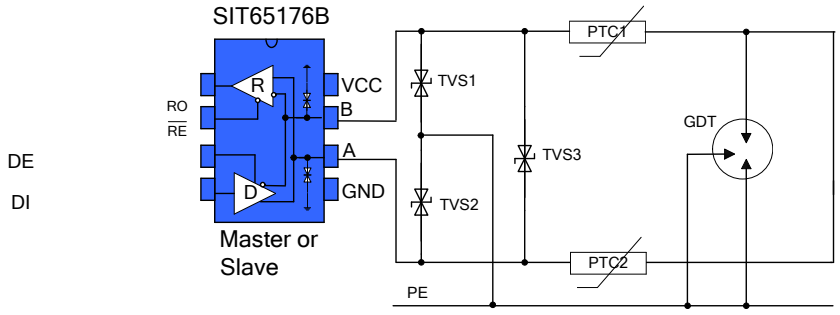


Figure 10 Hand-in-hand RS485 half-duplex communication network

3.3 Total Bus Protection: In harsh environments, RS485 communication ports are typically equipped with additional protections such as electrostatic protection and surge protection against lightning strikes. They may even require measures to prevent the connection of 380V mains power to avoid damage to smart meters and industrial control hosts. Figure 11 shows three common RS485 bus port protection schemes. The first scheme involves paralleling TVS devices between the AB ports to ground, with TVS devices also connected in parallel between the AB ports, and thermistors and gas discharge tubes connected in series between the AB ports to form a three-level protection system. The second scheme involves paralleling TVS devices between the AB ports to ground, connecting thermistors in series between the AB ports, and paralleling varistors between the AB ports for a three-level protection system. The third scheme involves connecting pull-up resistors to the power supply and ground between the AB ports, connecting TVS devices between the AB ports, and connecting a thermistor to either port A or B.



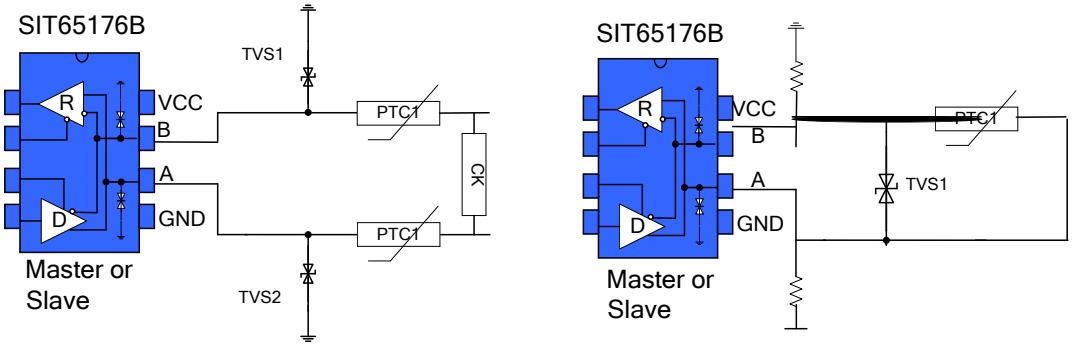
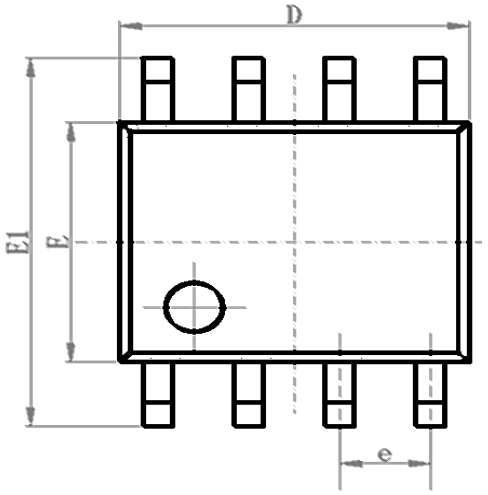


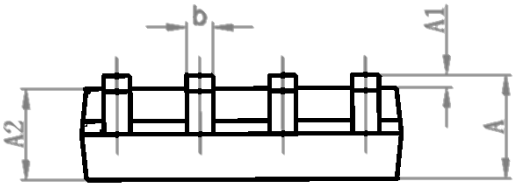
Figure 11 Port protection scheme

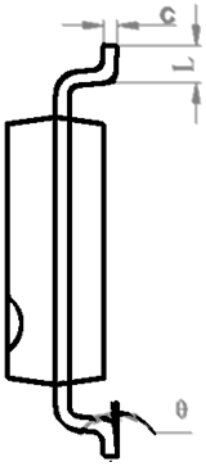
SOP8, external dimensions

Package size

Symbol	Least value /mm	Representative value / mm	Crest value /mm
A	1.40	-	1.80
A1	0.10	-	0.25
A2	1.30	1.40	1.50
b	0.38	-	0.51
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
e		1.27BSC	
L	0.40	0.60	0.80
c	0.20	-	0.25
θ	0°	-	8°



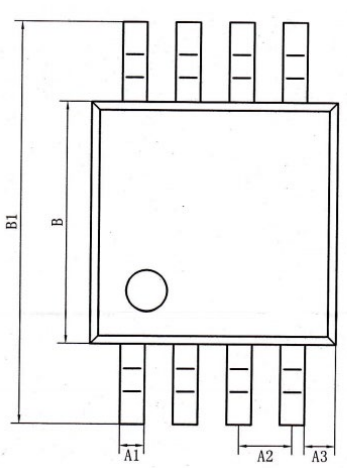


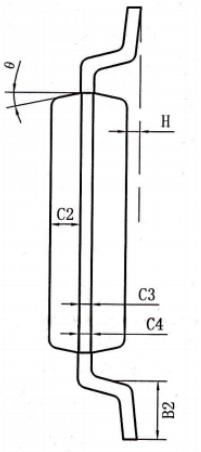


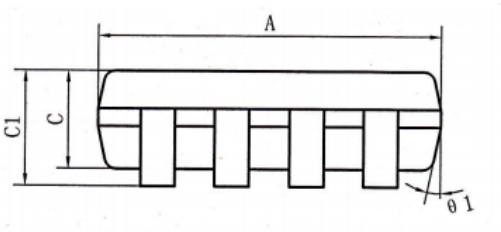
MSOP8/8μMAX/VSSOP8 Dimensions

Package size

Symbol	Least value /mm	Representative value / mm	Crest value /mm
A	2.90	3.0	3.10
A1	0.28		0.35
A2	0.65TYP		
A3	0.375TYP		
B	2.90	3.0	3.10
B1	4.70		5.10
B2	0.45		0.75
C	0.75		0.95
C1			1.10
C2	0.328 TYP		
C3	0.152		
C4	0.15		0.23
H	0.00		0.09
θ	12°TYP		



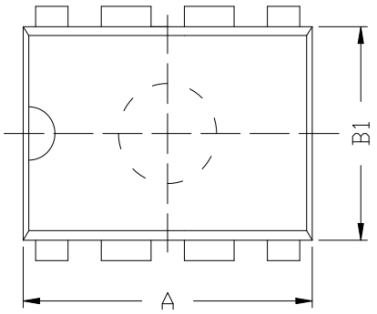


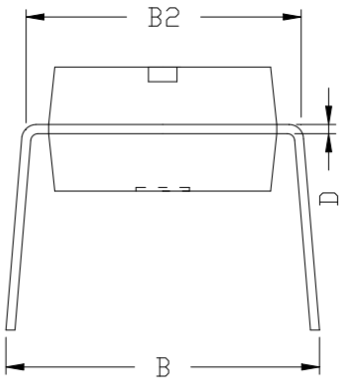


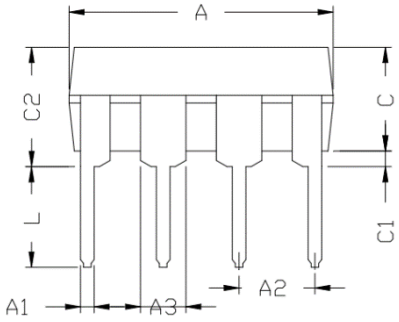
DIP8, external dimensions

Package size

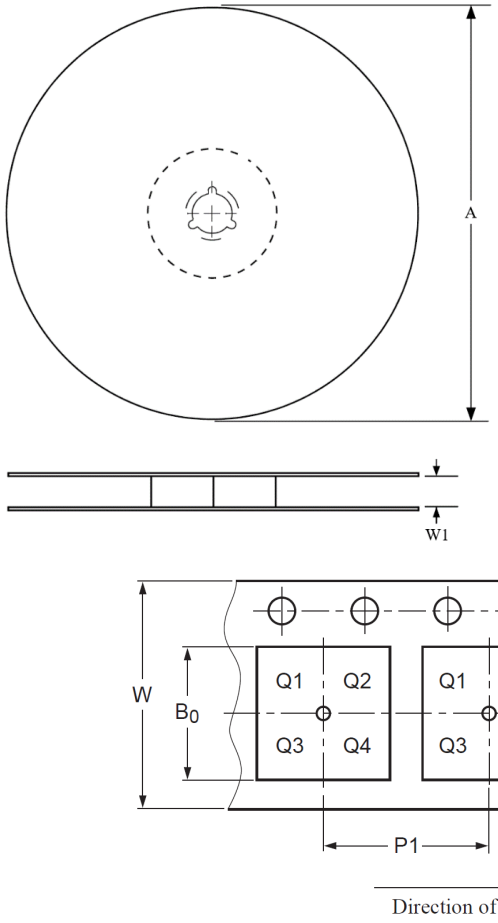
Symbol	Least value /mm	Representative value / mm	Crest value /mm
A	9.00	9.20	9.40
A1	0.33	0.45	0.51
A2	2.54TYP		
A3	1.525TYP		
B	8.40	8.70	9.10
B1	6.20	6.40	6.60
B2	7.32	7.62	7.92
C	3.20	3.40	3.60
C1	0.50	0.60	0.80
C2	3.71	4.00	4.31
D	0.20	0.28	0.36
L	3.00	3.30	3.60







Bandwidth information



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

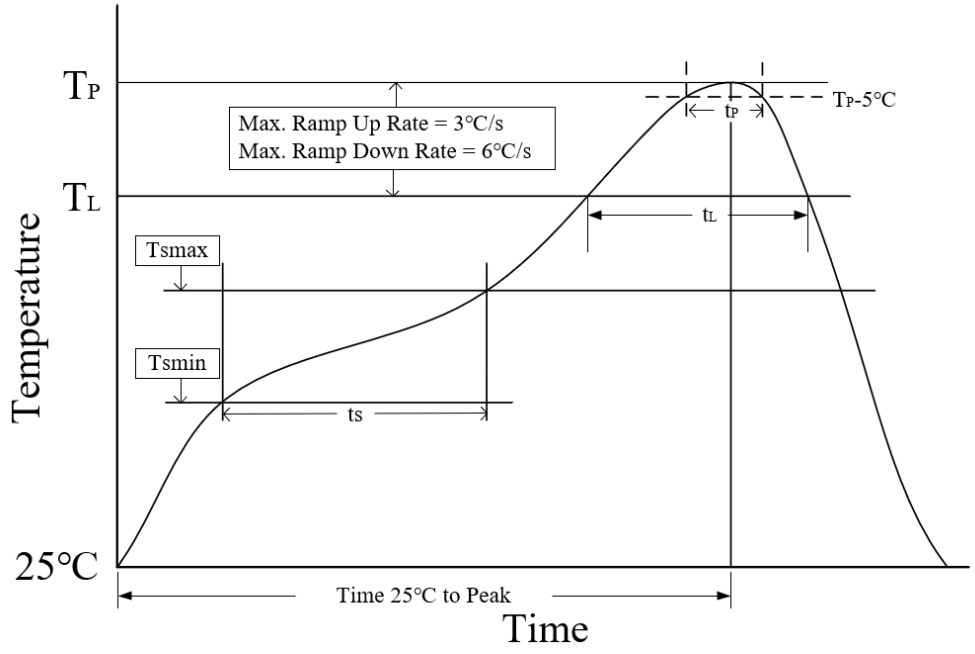
PIN1 is in quadrant 1

Packaging type	Diameter of coil A (mm)	Band width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP8	330	12.5±0.20	6.50±0.1	5.30±0.10	2.05±0.1	8.00±0.1	12.00±0.1
MSOP8	330	12.5±0.20	5.33±0.10	3.40±0.10	1.53±0.10	8.00±0.10	$12.00^{+0.30}_{-0.10}$

Order information

Order code	Package	Manner of packing
SIT65176BDR	SOP8	Strapping and packaging
SIT65176BDGK	MSOP8/VSSOP8/8μMAX	Strapping and packaging
SIT65176BP	DIP8	Cylindrical packaging

The tape packaging is 2500 per disc and the tube packaging is 50 per tube.



Parameter	Lead-free welding conditions
Average temperature rise rate (TL to TP)	3 °C/second max
Preheating time ts (Tsmin=150 to Ts-max=200)	60-120 seconds
Time of tin melting tL (TL=217)	60-150 seconds
Maximum temperature TP	260-265 °C
Time tP less than the peak temperature 5	30 seconds
Average cooling rate (TP to TL)	6 °C/second max
Room temperature 25 to peak temperature TP time	8 minutes max

Important statement

Cenlite reserves the right to change the above information without prior notice.

Revision of the history

Version number	Revision content	Revision date
V1.0	Initial version.	2020.01
V1.1	Format adjustments.	2020.01
V1.2	Format adjustments.	2019.11
V1.3	Update the working temperature range; Update VOD2 indicators; Update the VIT+ index; Update power supply current index; Update the driver switch characteristics index; Update receiver switch characteristic indicators.	2020.03
V1.4	Update the working temperature range; add "Important statement".	2021.12
V1.5	Update SOP8 packaging dimensions information	2022.01
V1.6	Update the test diagram; add tape information; update the order information; add reflow soldering information; add revision history.	2022.12