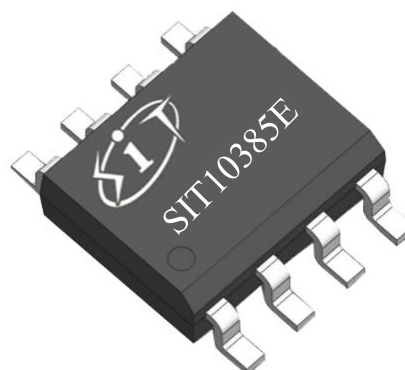


FEATURES

- 5V power supply, half-duplex
- 1/8 unit load, allow up to 256 transceivers on the bus
- Driver short-circuit output protection
- Overtemperature protection
- Low power off function
- Receiver open-circuit failure protection
- Strong anti-noise ability
- Integrated transient voltage suppression function
- Data transmission up to 5Mbps in an electric noise environment
- ESD protection for A, B pins: contact discharge 15kV

PRODUCT APPEARANCE



Provide green and environmentally friendly
lead-free package

DESCRIPTION

SIT13085E is a RS-485 transceiver with 5V power supply, half duplex, low power consumption, and fully meets the requirements of TIA/EIA-485 standard.

SIT13085E includes a driver and a receiver, both of which can be enabled and closed independently. When both are disabled, both the driver and the receiver output are high resistance state. SIT13085E has 1/8 load, which allows 256 SIT13085E transceivers to be connected to the same communication bus. It can realize error-free data transmission up to 5Mbps.

SIT13085E has a working voltage range of 4.5V~5.5V, and has the functions of fail-safe, current-limiting protection, over-voltage protection, etc.

SIT13085E has excellent ESD release ability, contact discharge meets IEC61000-4-2 ±15kV.

PIN CONFIGURATION

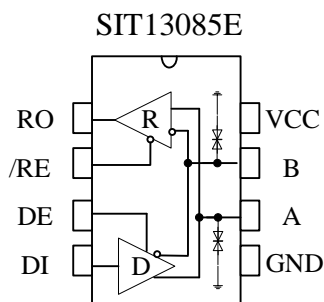


Fig 1 SIT13085E pin configuration

PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1	RO	Receiver Output. When /RE is low and if $A-B \geq -10\text{mV}$, RO will be high; if $A-B \leq -200\text{mV}$, RO will be low.
2	/RE	Receiver Output Enable. Drive /RE low to enable RO; RO is high impedance when /RE is high. Drive /RE high and DE low to enter low-power shutdown mode.
3	DE	Driver Output Enable. Drive DE high to enable driver outputs. These outputs are high impedance when DE is low. Drive /RE high and DE low to enter low-power shutdown mode.
4	DI	Driver Input. With DE high, a low on DI forces non-inverting output low and inverting output high. Similarly, a high on DI forces non-inverting output high and inverting output low.
5	GND	Ground.
6	A	Non-inverting receiver input and non-inverting driver output.
7	B	Inverting Receiver Input and Inverting Driver Output.
8	VCC	Positive supply.

LIMITING VALUES

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	+7	V
Control Input Voltage	/RE, DE, DI	-0.3~VCC+0.3	V
Receiver Input Voltage	A, B	-7~13	V
Receiver Output Voltage	RO	-0.3~VCC+0.3	V
Operating Temperature Range	T _A	-40~85	°C
Storage Temperature Range	T _j	-60~150	°C
Welding temperature		300	°C
Continuous power dissipation	SOP8	400	mW
	DIP8	700	mW

The maximum limit parameters mean that exceeding these values may cause irreversible damage to the device. Under these conditions, it is not conducive to the normal operation of the device. The continuous operation of the device at the maximum allowable rating may affect the reliability of the device. The reference point for all voltages is ground.

DRIVER DC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Differential Driver Output (No load)	V _{OD1}			5		V
Differential Driver Output	V _{OD2}	Fig 2 , R _L = 54Ω		3.5	VCC	V
		Fig 2 , R _L = 100 Ω		4.0	VCC	V
Change in Magnitude of Output Voltage (NOTE1)	ΔV _{OD}	Fig 2 , R _L = 54 Ω			0.2	V
Common-Mode Output Voltage	V _{OC}	Fig 2 , R _L = 54 Ω			3	V
Change in Magnitude of Common-Mode Output Voltage (NOTE1)	ΔV _{OC}	Fig 2 , R _L = 54 Ω			0.2	V

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input High Voltage	V_{IH}	DE, DI, /RE	2.0			V
Input Low Voltage	V_{IL}	DE, DI, /RE			0.8	V
Logic Input Current	I_{IN1}	DE, DI, /RE	-2		2	μA
Output short-circuit current, short-circuit to high	I_{OSD1}	Short-circuit to 0V~12V	35		250	mA
Output short-circuit current, short-circuit to high	I_{OSD2}	Short-circuit to -7V~0V	-250		-35	mA
Thermal shutdown threshold temperature				150		$^{\circ}C$
Thermal shutdown hysteresis temperature				20		$^{\circ}C$

(Unless otherwise noted, $V_{CC}=5V\pm 10\%$, $Temp=T_{MIN}\sim T_{MAX}$, all typical values are measured in $V_{CC}=+5V$, $T_A=25^{\circ}C$)

NOTE1: ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC} , respectively, when the DI input changes state.

RECEIVER DC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input Current (A, B)	I_{IN2}	DE = 0 V, VCC=0 or 5V $V_{IN} = 12 V$			125	μA
		DE = 0 V, VCC=0 or 5V $V_{IN} = -7 V$	-100			μA
Positive Input Threshold Voltage	V_{IT+}	$-7V \leq V_{CM} \leq 12V$			-10	mV
Reverse Input Threshold Voltage	V_{IT-}	$-7V \leq V_{CM} \leq 12V$	-200			mV
Input Hysteresis Voltage	V_{hys}	$-7V \leq V_{CM} \leq 12V$	10	30		mV
Output High Voltage	V_{OH}	$I_{OUT} = -4mA$, $V_{ID} = +200 mV$	$V_{CC}-1.5$			V
Output Low Voltage	V_{OL}	$I_{OUT} = +4mA$, $V_{ID} = -200 mV$			0.4	V
Three-State input leakage current	I_{OZR}	$0.4 V < V_O < 2.4 V$			± 1	μA

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Receiver Input Resistance	R_{IN}	$-7V \leq V_{CM} \leq 12V$	96			k Ω
Receiver Short-Circuit Current	I_{OSR}	$0V \leq V_{O} \leq V_{CC}$	± 7		± 95	mA

(Unless otherwise noted, $V_{CC}=5V \pm 10\%$, $Temp=T_{MIN} \sim T_{MAX}$, all typical values are measured in $V_{CC}=+5V$, $T_A=25^\circ C$)

SUPPLY CURRENT

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Current	I_{CC1}	/RE=0V, DE = 0 V		600	750	μA
	I_{CC2}	/RE=VCC, DE=VCC		580	750	μA
Shutdown Current	I_{SHDN}	/RE=VCC, DE=0V		0.5	10	μA

ESD

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
A, B		Contact discharge		± 15		kV
Other ports		Human body mode (HBM)		± 2		kV

DRIVER SWITCHING CHARACTERISTIC

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Driver Input to Output Propagation Delay (Low to High)	t_{DPLH}	$R_{DIFF} = 54\Omega$, $C_{L1}=C_{L2}=100pF$ Fig 3 & Fig 4		20	60	ns
Driver Input to Output Propagation Delay (High to Low)	t_{DPHL}			20	60	ns
$ t_{DPLH}-t_{DPHL} $	t_{SKEW1}				± 10	ns
Rising time/Falling time	t_{DR} , t_{DF}				5	10

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable to Output High	t_{DZH}	$C_L = 100\text{pF}$, S1 closed		30	100	ns
Enable to Output Low	t_{DZL}	Fig 5 & Fig 6		30	100	ns
Output Low to Enable	t_{DLZ}	$C_L = 15\text{pF}$, S2 closed		70	100	ns
Input High to Disable	t_{DHZ}	Fig 5 & Fig 6		70	100	ns
In Shutdown mode, Enable to Output High	$t_{DZH(SHDN)}$	$C_L = 15\text{pF}$, S2 closed Fig 5 & Fig 6		600	1100	ns
In Shutdown mode, Enable to Output Low	$t_{DZL(SHDN)}$	$C_L = 15\text{pF}$, S1 closed Fig 5 & Fig 6		600	1100	ns

RECEIVER SWITCHING CHARACTERISTICS

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Receiver Input to Output Propagation Delay (Low to High)	t_{RPLH}	$V_{ID} \geq 2.0\text{V}$; Rising and falling time $V_{ID} \leq 15\text{ns}$		90	140	ns
Receiver Input to Output Propagation Delay (High to Low)	t_{RPHL}			90	140	ns
$ t_{RPLH} - t_{RPHL} $	t_{SKEW2}			6	10	ns
Enable to Output Low	t_{RZL}	$C_L = 100\text{pF}$, S1 closed Fig 9 & Fig 10		30	54	ns
Enable to Output High	t_{RZH}	$C_L = 100\text{pF}$, S2 closed Fig 9 & Fig 10		30	54	ns
Output Low to Disable Time	t_{RLZ}	$C_L = 100\text{pF}$, S1 closed, Fig 9 & Fig 10		30	56	ns
Output High to Disable Time	t_{RHZ}	$C_L = 100\text{pF}$, S2 closed, Fig 9 & Fig 10		30	56	ns
In Shutdown State, Enable to Output High Time	$t_{RZH(SHDN)}$	$C_L = 100\text{pF}$, S2 closed, Fig 9 & Fig 10		230	1300	ns

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
In Shutdown State, Enable to Output Low Time	$t_{RZL(SHDN)}$	$C_L=100\text{pF}$, S1 closed, Fig 9 & Fig 10		230	1300	ns
Time to Shutdown	t_{SHDN}	NOTE2	50	150	400	ns

NOTE2: when /RE=1 and DE=0 for less than 50ns, the device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 400ns, the device is guaranteed to have entered shutdown.

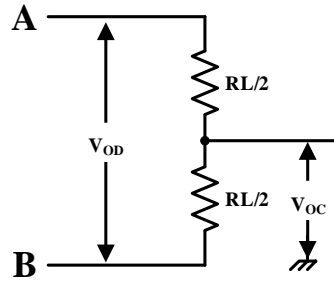
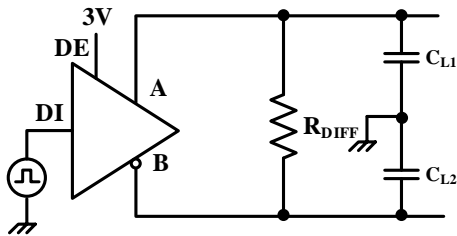
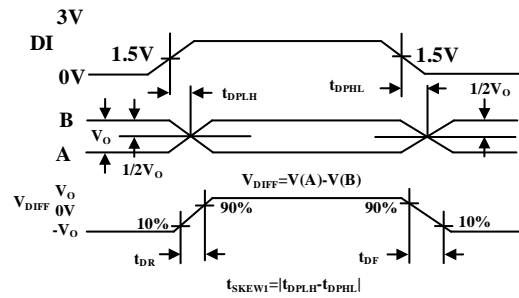
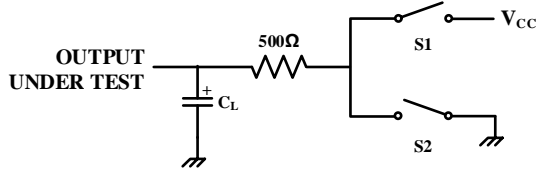
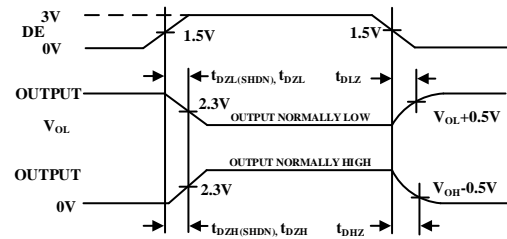
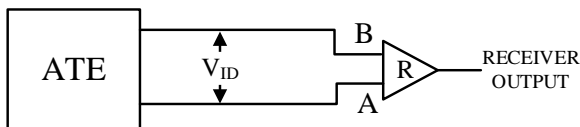
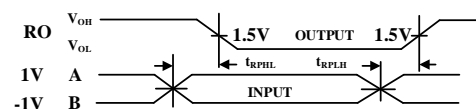
FUNCTION TABLE

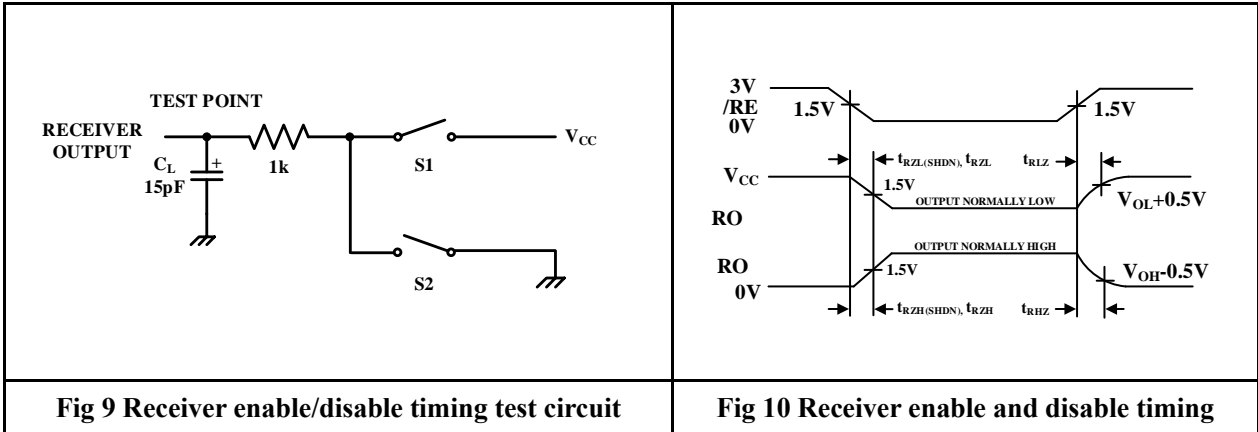
Driver Function

CONTROL		INPUT	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=irrelevant; Z=high impedance				

Receiver Function

CONTROL		INPUT	OUTPUT
/RE	DE	A-B	RO
0	X	$\geq 10\text{mV}$	H
0	X	$\leq -200\text{mV}$	L
0	X	Open/Short circuit	H
1	X	X	Z
X=irrelevant; Z=high impedance			

TEST CIRCUIT

Fig 2 Driver DC test load

Fig 3 Driver timing test circuit

Fig 4 Driver propagation delay

Fig 5 Driver enable/disable timing test circuit

Fig 6 Driver enable/disable timing

Fig 7 Receiver propagation delay test circuit

Fig 8 Receiver propagation delay timing



ADDITIONAL DESCRIPTION

1 Sketch

SIT13085E is a half-duplex high-speed transceiver, used for RS-485/RS-422 communication, including a driver and a receiver. It has the function of fail-safe, over-voltage protection, over-current protection, over-temperature protection. SIT13085E can realize error-free data transmission up to 5Mbps.

2 Fail-safe

The SIT13085E ensures a logic high output from the receiver when the receiver input is shorted or open circuit, or when all drivers are idle and connected to the terminated transmission line. This is achieved by setting the receiver input thresholds to -10mV and -200mV respectively. If the differential receiver input voltage $(A-B) \geq -10\text{mV}$, RO is logic high; if voltage $(A-B) \leq -200\text{mV}$, RO is logic low. When all transmitters are disabled and connected to the terminated bus, the receiver differential input voltage will be pulled to 0V through the termination resistor. Depending on the receiver thresholds, a logic high with a minimum noise margin of 50mV can be realized. The -10mV to -200mV threshold voltage is compliant with the $\pm 200\text{mV}$ EIA / TIA-485 standard.

3 Allowing up to 256 transceivers on the bus

The input impedance of the standard RS485 receiver is $12\text{k}\Omega$ (1 unit load), and the standard driver can drive up to 32 unit loads. The receiver of SIT13085E transceiver has 1/8 unit load input impedance ($96\text{k}\Omega$), which allows up to 256 transceivers to be connected on the same communication bus in parallel. These devices can be combined arbitrarily or with other RS485 transceivers. Any combination of these devices and/or other RS-485 transceivers with a total of 32 unit loads or less can be connected to the line.

4 Driver output protection

Through two mechanisms to avoid the excessive output current and high power consumption caused by failure or bus conflict. The first one, over-current protection features fast short circuit protection in the whole common-mode voltage range (reference typical operating characteristics). Second, thermal shutdown circuit, when the core temperature exceeds 150°C , the output of the driver is forced into the high resistance state.

5 Typical Applications

5.1 Bus Networking: SIT13085E RS485 transceiver is designed for bidirectional data communication on multi-point bus transmission line. [Fig 11](#) shows a typical network application circuit. These devices can also be used as linear repeaters with cables longer than 4000 feet. In order to reduce reflection, terminal matching should be carried out at both ends of the transmission line with its characteristic impedance, and the length of branch lines outside the main line should be as short as possible.

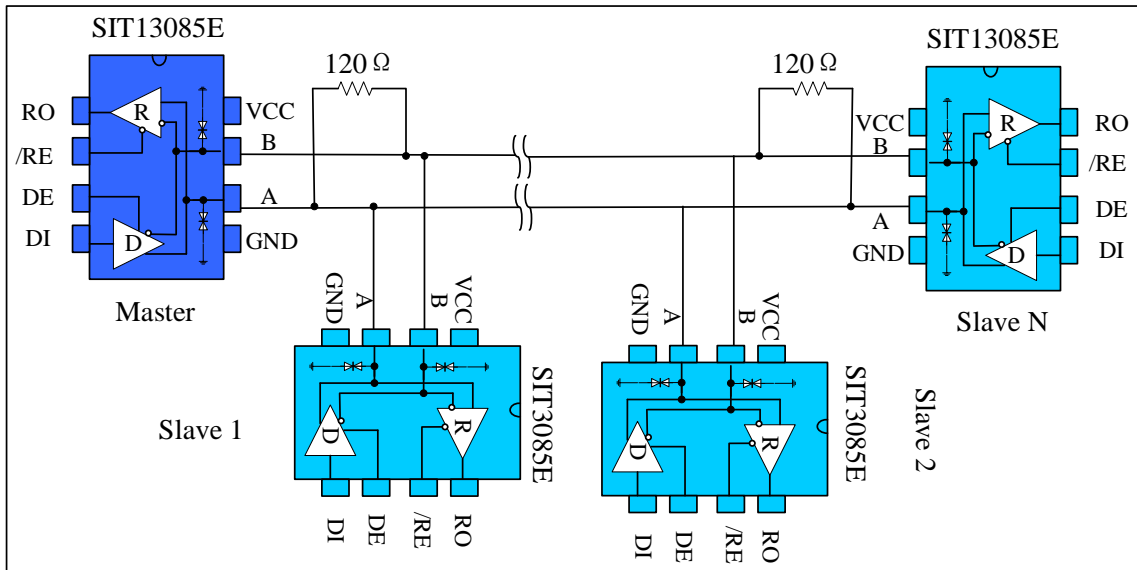


Fig 11 Bus type RS485 half-duplex communication network

5.2 Hand in hand Networking: also known as daisy chain topology, is the standard and specification of RS485 bus wiring, and is the RS485 bus topology recommended by TIA and other organizations. The wiring mode is that the main control equipment and a plurality of slave control equipment form a hand-held connection mode, as shown in Fig 12, and the hand-held mode is no branches. This wiring mode has the advantages of small signal reflection and high communication success rate.

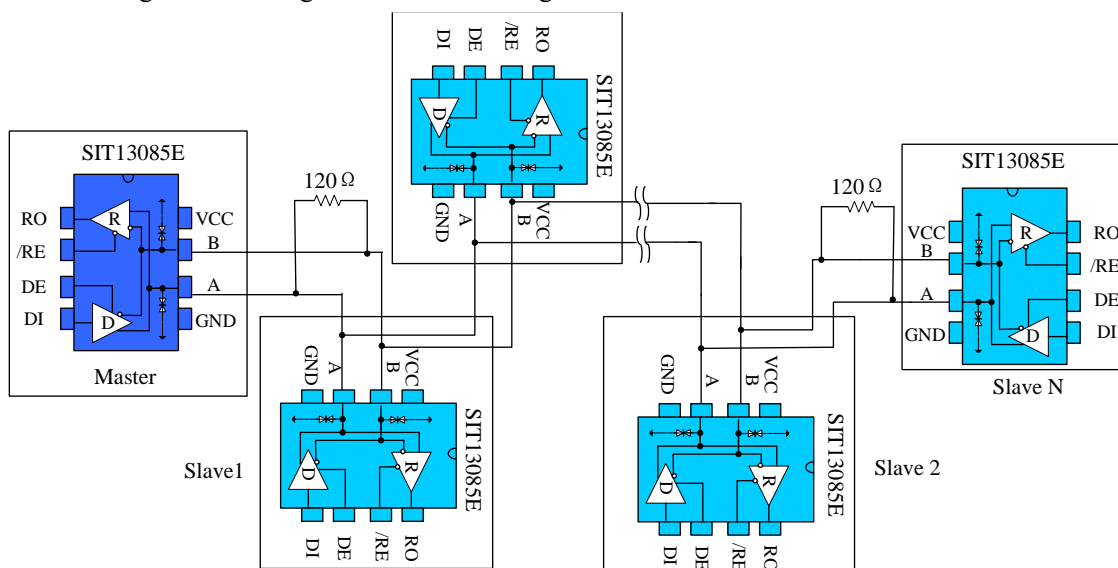


Fig 12 Hand in hand RS485 half-duplex communication network

5.3 Bus port protection: in severe environment, RS485 communication port is usually provided with electrostatic protection, lightning surge protection and other additional protection, and even the plan to prevent 380V market electricity access is needed to avoid the damage of intelligent instrument and industrial control host. Fig 13 shows three common RS485 bus port protection schemes. The first is the scheme of three-level protection by connecting TVS devices in parallel with A,B port to the protective ground, TVS devices in parallel with A,B port, thermistor in series with A,B port, gas discharge tube in

parallel to the protective ground; the second is the scheme of three-level protection by connecting TVS in parallel with A,B port to the ground, thermistor in series with A,B port, and varistor in parallel with A,B port; the third is the scheme of three-level protection by connecting AB with pull-up or pull-down resistor to power and ground respectively, connecting TVS between A & B, A or B port connecting thermistor.

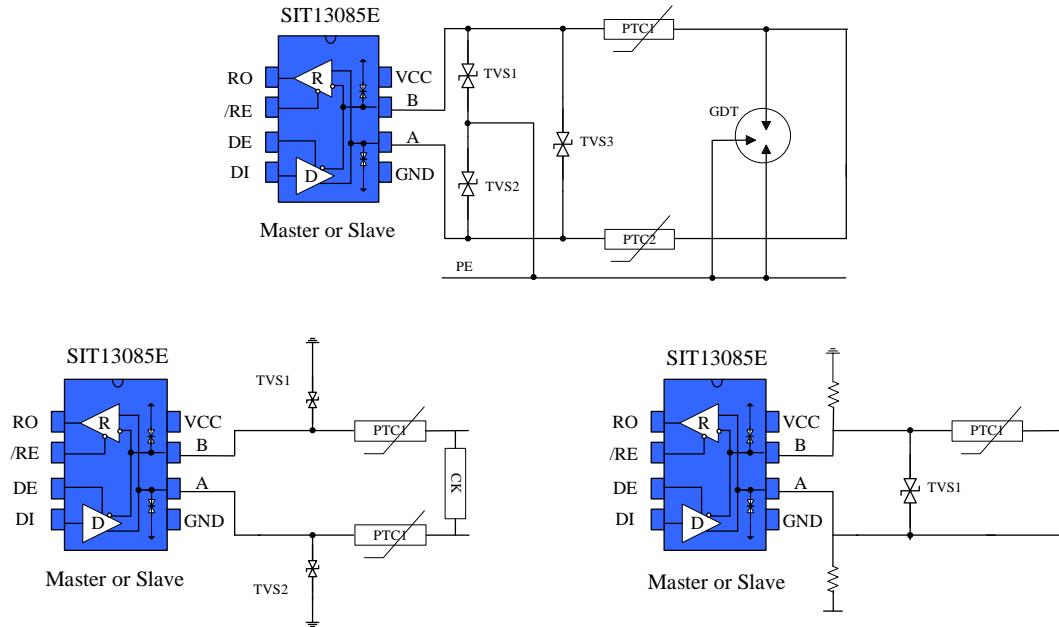
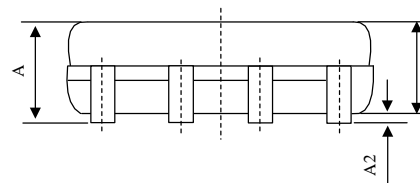
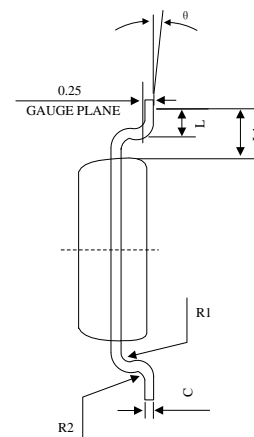
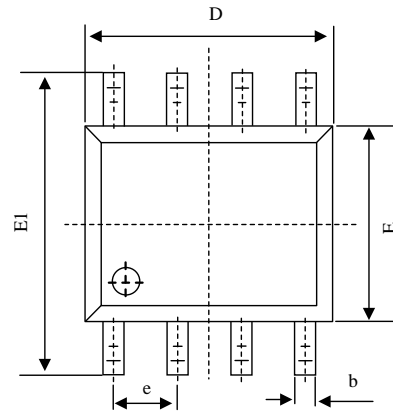


Fig 13 Port protection scheme

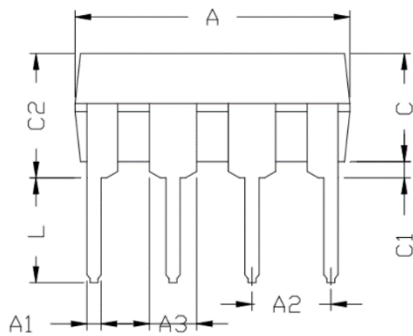
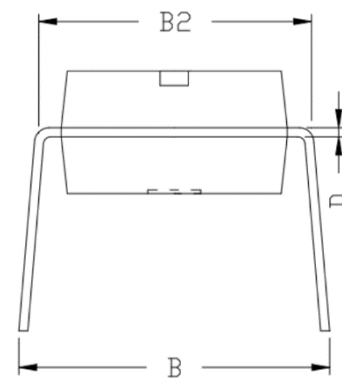
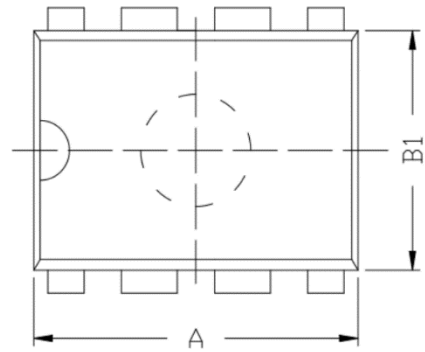
SOP8 DIMENSIONS
PACKAGE SIZE

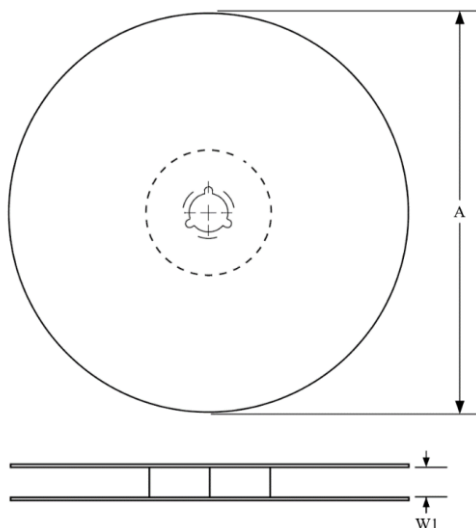
Symbol	MIN./mm	TYP./mm	MAX./mm
A	1.40	1.60	1.80
A1	0.05	0.15	0.25
A2	1.35	1.45	1.55
b	0.30	0.40	0.50
c	0.153	0.203-	0.253
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
L	0.45	0.70	1.00
θ	2°	4°	6°
L1	1.04 REF		
e	1.27 BSC		
R1	0.07 TYP		
R2	0.07 TYP		



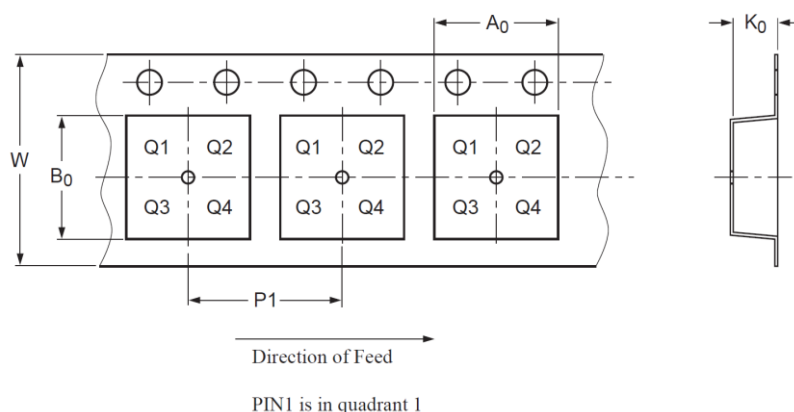
DIP8 DIMENSIONS
PACKAGE SIZE

Symbol	MIN./mm	TYP./mm	MAX./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



TAPE AND REEL 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



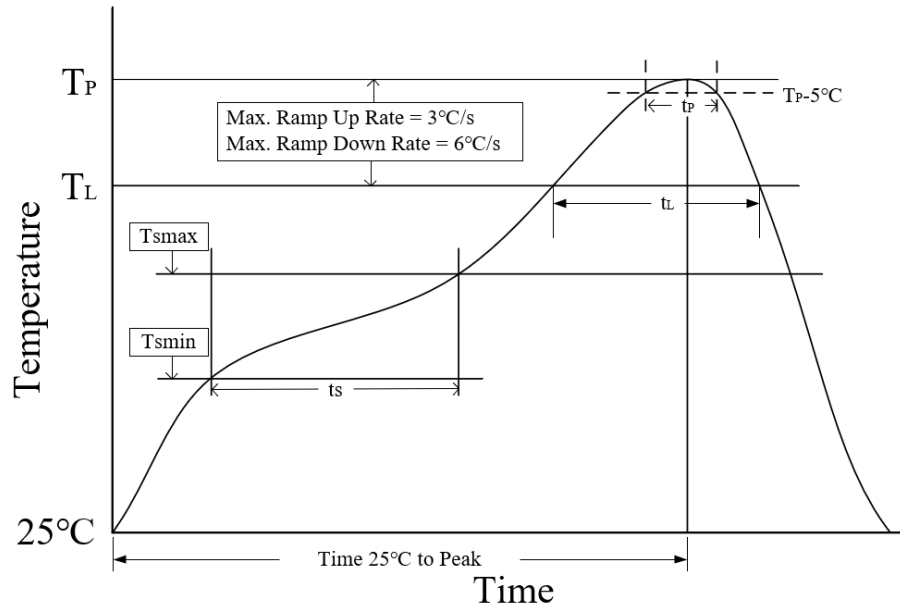
PIN1 is in quadrant 1

Package Type	Reel Diameter A (mm)	Tape Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP8	330±2	12.4	6.50±0.1	5.30±0.10	2.05±0.1	8.00±0.1	12.00±0.1

ORDERING INFORMATION

Type number	Package	Packing
SIT13085EESA	SOP8	Tape and reel
SIT13085EIPA	DIP8	Tube

SOP8 is packed with 2500 pieces/disc in braided packaging. DIP8 is packed with 50 pieces/tube in tubed packaging.

REFLOW SOLDERING


Parameter	Lead-free soldering conditions
Ave ramp up rate (T_L to T_P)	3 °C/second max
Preheat time t_s ($T_{smin}=150^\circ\text{C}$ to $T_{smax}=200^\circ\text{C}$)	60-120 seconds
Melting time t_L ($T_L=217^\circ\text{C}$)	60-150 seconds
Peak temp T_P	260-265 °C
5°C below peak temperature t_P	30 seconds
Ave cooling rate (T_P to T_L)	6 °C/second max
Normal temperature 25°C to peak temperature T_P time	8 minutes max

Important statement

SIT reserves the right to change the above-mentioned information without prior notice.

REVISION HISTORY

Version number	Data sheet status	Revision date
V1.0~V1.2	Product datasheet.	October 2018
V1.3	Deleted “hot swap input” information; Updated V_{IT+} parameter; Updated test circuit and test condition; Updated SOP8 dimensions; Added tape and reel information; Updated ordering information; Added reflow soldering; Added revision history; Adjusted format	November 2023