FEATURES

- 5V power supply, half-duplex
- 1/8 unit loads, allow up to 256 transceivers on the bus
- Short-circuit protection
- Overtemperature protection
- Low power off function
- /RE, DE ports allow hot plug input
- Receiver open-circuit failure protection；
- Strong anti-noise ability
- Integrated transient voltage suppression
- 32-node communication rate up to 2.5Mbps
- A, B ports protection: contact discharge ±15kV; HBM±15kV

PRODUCT APPEARANCE

Provide environmentally friendly lead-free package

DESCRIPTION

SIT485E is a 5V power supply, half-duplex, low power, low slew rate RS485 transceiver which is fully compliant with the TIA/EIA-485 standard.

SIT485E 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-impedance state. SIT485E has 1/8 load and allows 256 transceivers to be connected to the same communication bus. Using a voltage-limited slew rate driver can significantly reduce EMI and reflections due to improper termination matching cabling. 32 nodes can achieve 2.5Mbps communication rate.

SIT485E has a working voltage range of 4.75~5.25V, and has the functions of fail-safe, current-limiting protection, over-voltage protection, hot plug input of control port, etc.

SIT485E has excellent ESD discharge capability, HBM reaches ± 15kV, contact discharge, IEC61000-4-2 ± 15kV.

PIN CONFIGURATION

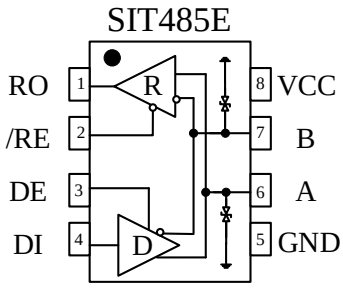


Fig 1 SIT485E pin configuration

PIN DESCRIPTION

Pin	Symbol	Description
1	RO	Receiver data output. When /RE is low and if A-B≥-50mV, RO will be high; if A-B≤-200mV, 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	Range	Unit
Supply voltage	VCC	+7	V
Control input voltage	/RE, DE, DI	-0.3~VCC+0.3	V
Bus side input voltage	A, B	-7~13	V
Receiver output voltage	RO	-0.3~VCC+0.3	V
Operating temperature	T_A	-40~85	℃
Storage temperature	T_{stg}	-60~150	℃
Welding temperature		300	℃
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.

DC ELECTRICAL CHARACTERISTICS OF DRIVER

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Differential output voltage (no load)	V_{OD1}			5		V
Differential output voltage	V_{OD2}	Fig 2, R_L=54Ω	1.5		5	V
		Fig 2, R_L=100Ω	2			
Change in magnitude of output voltage（NOTE1）	ΔV_{OD}	Fig 2, R_L=54Ω			0.2	V
Common-mode output voltage	V_{OC}	Fig 2, R_L=54Ω			3	V
Change in magnitude of common-mode voltage (NOTE1)	ΔV_{OC}	Fig 2, R_L=54Ω			0.2	V
HIGH-level input voltage	V_{IH}	DE, DI, /RE	2.0			V
LOW-level input voltage	V_{IL}	DE, DI, /RE			0.8	V
Logic input current	I_{IN1}	DE, DI, /RE	-2		2	μA
Short-circuit output current, short to HIGH	I_{OSD1}	Short to 0V~12V	35		250	mA
Short-circuit output current, short to LOW	I_{OSD2}	Short to -7V~0V	-250		-35	mA
Thermal-shutdown threshold temperature				150		℃
Thermal-shutdown hysteresis temperature				20		℃

(Unless otherwise stated, V_{CC}=5V±10%, T_A=-40℃~85℃, all typical values measured at V_{CC}=+5V, T_A=25℃.)

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

DC ELECTRICAL CHARACTERISTICS OF RECEIVER

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input current (A, B)	I_{IN2}	DE=0V, VCC=0 or 5V			125	μA
		DE=0V, VCC=0 or 5V	-100			μA
Positive-going input threshold voltage	V_{IT+}	-7V≤V_{CM}≤12V			-50	mV
Negative-going input threshold voltage	V_{IT-}	-7V≤V_{CM}≤12V	-200			mV
Receiver input hysteresis voltage	V_{hys}	-7V≤V_{CM}≤12V	10	30		mV
HIGH-level output voltage	V_{OH}	I_{OUT}=−4mA, V_{ID}=+200mV	VCC-1.5			V
LOW-level output voltage	V_{OL}	I_{OUT}=+4mA, V_{ID}=-200mV			0.4	V
Three-state leakage current	I_{OZR}	0.4V<V_O<2.4V			±1	μA
Receiver input resistance	R_{IN}	-7V≤V_{CM}≤12V	96			kΩ
Receiver output short-circuit	I_{OSR}	0 V≤V_O≤VCC	±7		±95	mA

(Unless otherwise stated, V_{CC}=5V±10%, T_A=-40°C~85°C, all typical values measured at V_{CC}=+5V, T_A=25°C.)

SUPPLY CURRENT

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply current	I_{CC1}	/RE=0V, DE=0V		180	500	μA
	I_{CC2}	/RE=VCC, DE=VCC		170	400	μA
Shutdown current	I_{SHDN}	DE=0V, /RE=VCC		0.5	10	μA

SWITCHING CHARACTERISTICS OF DRIVER

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Driver Propagation Delay from Low to High	t_{DPLH}	R_{DIFF}=54Ω, C_L=100pF Fig 3 & Fig 4			1000	ns
Drive Propagation Delay from High to Low	t_{DPHL}				1000	ns
$\|t_{DPLH}- t_{DPHL}\|$	t_{SKEW1}				±100	ns
Rising time/falling time	t_{DR}, t_{DF}		200	500	700	ns
Driver Enable to Output High	t_{DZH}	C_L=100pF, S1 closed Fig 5 & Fig 6			2500	ns
Driver Enable to Output Low	t_{DZL}				2500	ns
Input low to disable	t_{DLZ}	C_L=100pF, S2 closed Fig 5 & Fig 6			100	ns
Input high to disable	t_{DHZ}	C_L=15pF, S2 closed Fig 5 & Fig 6			100	ns
In Shutdown mode, Enable to Output High	$t_{DZH(SHDN)}$	C_L=15pF, S2 closed Fig 5 & Fig 6			4500	ns
In Shutdown mode, Enable to Output Low	$t_{DZL(SHDN)}$	C_L=15pF, S1 closed Fig 5 & Fig 6			4500	ns

RECEIVER SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver Input to Output from Low to High	t_{RPLH}	Fig 7 & Fig 8 VID≥2.0V; rising and falling time VID≤15ns		127	200	ns
Receiver Input to Output from High to Low	t_{RPHL}			127	200	ns

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
$\|t_{RPLH}- t_{RPHL}\|$	t_{SKEW2}	Fig 7 & Fig 8		3	30	ns
Receiver Enable to Output Low	t_{RZL}	C_L=100pF, S1 closed, Fig 9 & Fig 10		20	50	ns
Receiver Enable to Output high	t_{RZH}	C_L=100pF, S2 closed, Fig 9 & Fig 10		20	50	ns
Output Low to Disable	t_{RLZ}	C_L=100pF, S1 closed, Fig 9 & Fig 10		20	50	ns
Output High to Disable	t_{RHZ}	C_L=100pF, S2 closed, Fig 9 & Fig 10		20	50	ns
In Shutdown Mode, Enable to Output High	$t_{RZH(SHDN)}$	C_L=100pF, S2 closed, Fig 9 & Fig 10			3500	ns
In Shutdown Mode, Enable to Output Low	$t_{RZL(SHDN)}$	C_L=100pF, S1 closed, Fig 9 & Fig 10			3500	ns
Time to Shutdown	t_{SHDN}	NOTE2	50	200	600	ns

NOTE2: If the enable inputs are /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 600ns, the device is guaranteed to have entered shutdown.

FUNCTION TABLE

Driver Function

CONTROL		INPUT	OUTPUT	
/RE	DE	DI	A	B
X	1	1	1	0
X	1	0	0	1
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	≥-50mV	1
0	X	≤-200mV	0
0	X	Open/short circuit	1
1	X	X	Z
1	1	X	Z (Shutdown)

TEST CIRCUIT

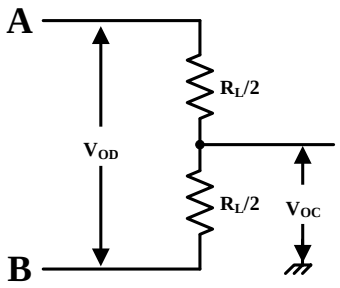


Fig 2 Driver DC test load

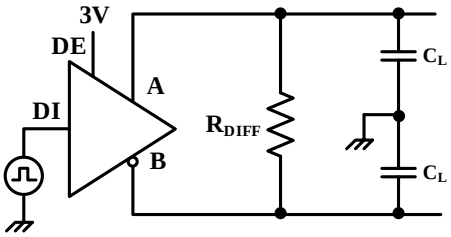


Fig 3 Driver timing test circuit

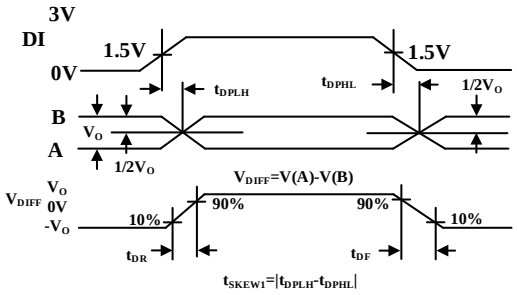


Fig 4 Driver propagation delay

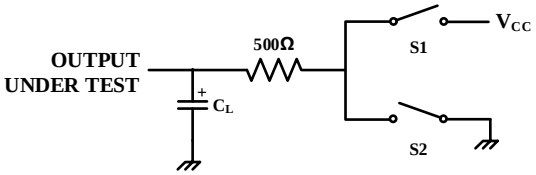


Fig 5 Driver enable/disable timing test circuit

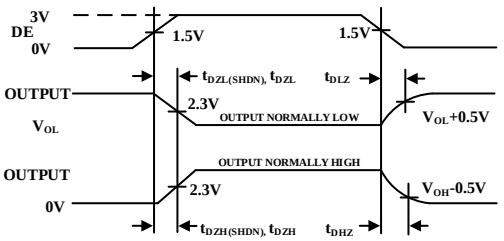


Fig 6 Driver enable/disable timing

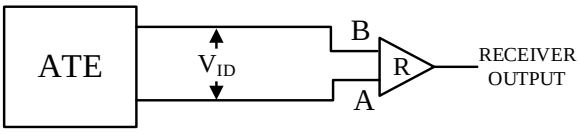


Fig 7 Receiver enable/disable timing test circuit

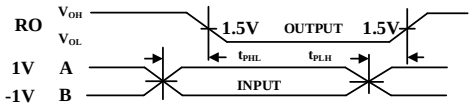


Fig 8 Receiver enable and disable timing

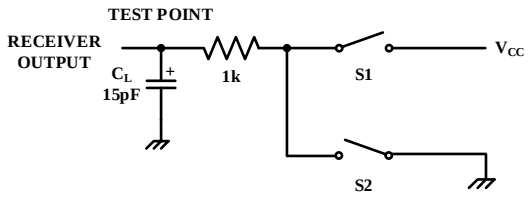


Fig 9 Receiver enable/disable timing test circuit

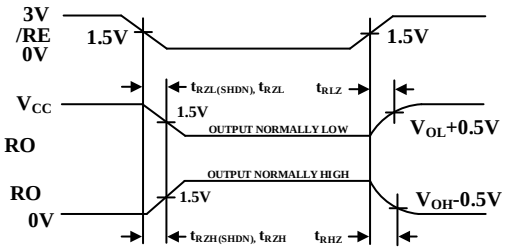


Fig 10 Receiver enable and disable timing

ADDITIONAL DESCRIPTION

1 Sketch

SIT485E is a half-duplex high-speed transceiver, used for RS-485/RS-422 communication, including a driver and a receiver. It has the functions of fail-safe, over-voltage protection, over-current protection, over-temperature protection. It allows /RE, DE port hot swap input.

SIT485E features a low slew rate driver, which can reduce reflections due to improper termination matching cabling. 32 nodes can achieve 2.5Mbps error-free data transfer.

2 Fail-safe

The SIT485E 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 threshold to -50mV and -200mV respectively. If the difference receiver input voltage (A-B) ≥ -50mV, RO is logic high; If voltage (A-B) ≤ -200mV, 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, the logic high with a minimum noise margin of 50mV can be realized. The -50mV to -200mV threshold voltage is compliant with the ±200mV EIA/TIA-485 standard.

3 Allowing up to 256 transceivers on the bus

The input impedance of the standard RS485 receiver is 12kΩ (1 unit load), and the standard driver can drive up to 32 unit loads. The receiver of SIT485E transceiver has 1/8 unit load input impedance (96kΩ), 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 Reduce EMI and reflection

SIT485E features a low slew rate driver, which can reduce reflections due to improper termination matching cabling. The driver's rising time is related to the length of the terminal.

5 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.

6 Typical Applications

SIT485E 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.

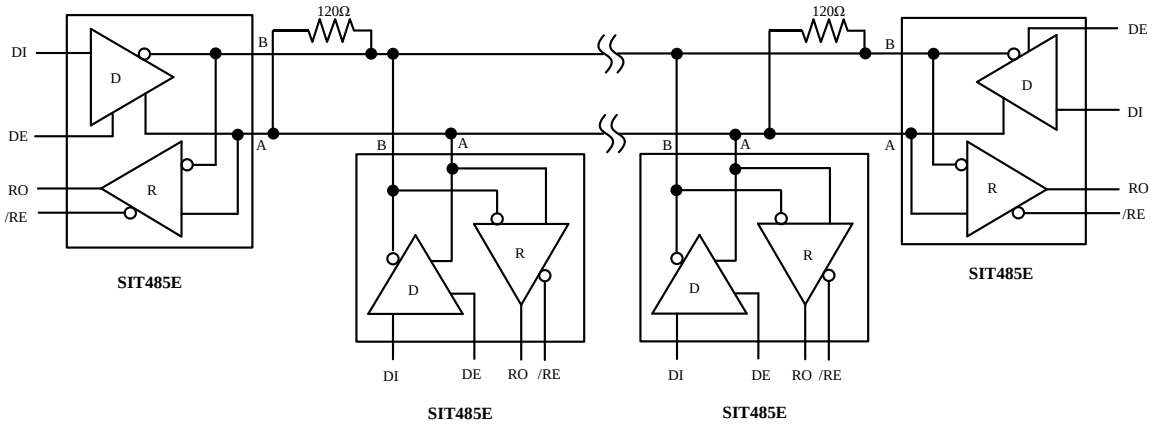
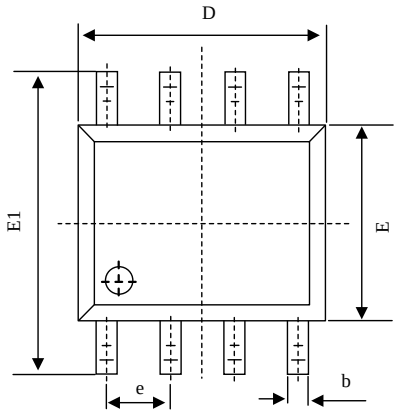


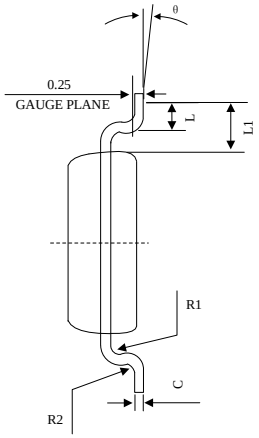
Fig 11 Typical RS485 half-duplex communication network

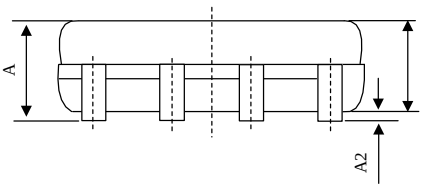
SOP8 DIMENSIONS

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		



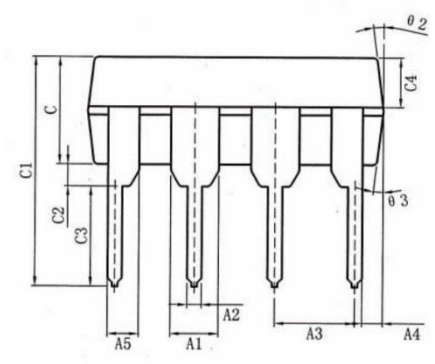


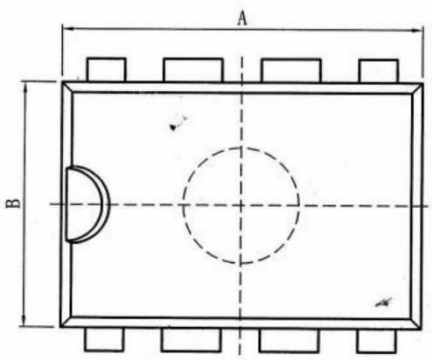


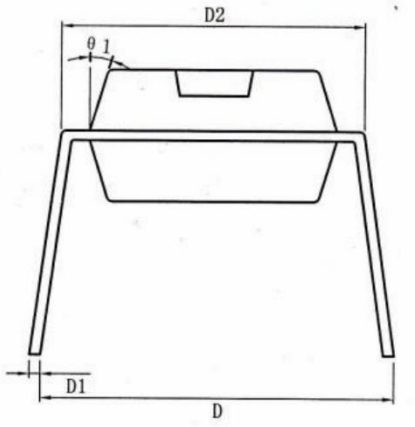
DIP8 DIMENSIONS

PACKAGE SIZE

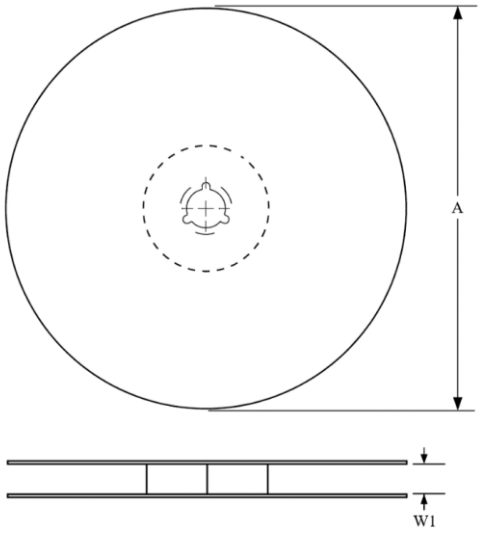
SYMBOL	MIN./mm	TYP./mm	MAX./mm
A	9.00		9.20
A1	1.474		1.574
A2	0.41		0.51
A3	2.44		2.64
A4		0.51TYP	
A5		0.99TYP	
B	6.10		6.30
C	3.20		3.40
C1	7.10		7.30
C2		0.50TYP	
C3	3.20		3.40
C4	1.47		1.57
D	8.20		8.80
D1	0.244		0.264
D2	7.62		7.87
θ1		17° TYP4	
θ2		10° TYP4	
θ3		8° TYP4	



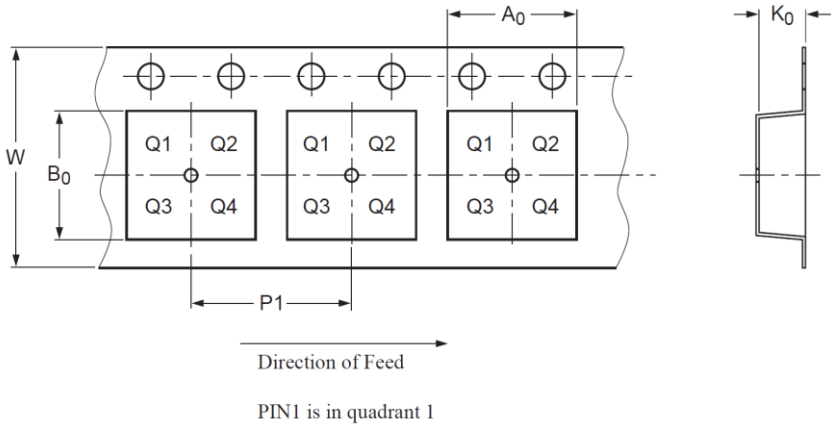




TAPE AND REEL INFORMATION



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

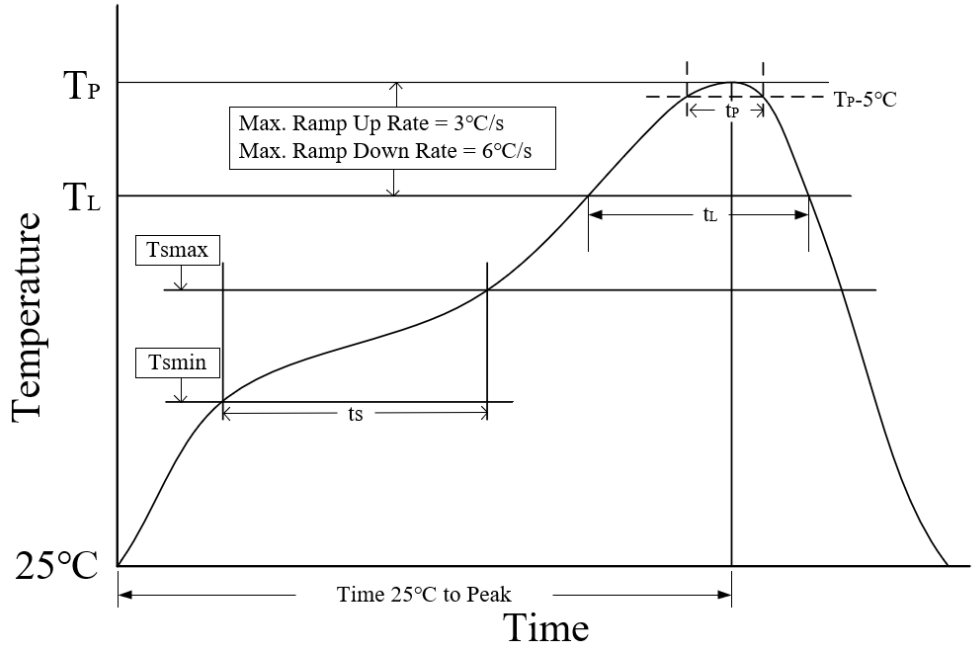
Package Type	Reel Diameter A (mm)	Tape Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)
SOP8	330±2	12.4	6.50±0.1	5.30±0.10	2.05±0.1	8.00±0.1	12.00±0.1

ORDERING INFORMATION

Type number	Package	Packing
SIT485EESA	SOP8	Tape and reel
SIT485EEPA	DIP8	Tube

SOP8 is packed with 2500 pieces/disc in braided packaging and 100 pieces/disc in tubed packaging. DIP8 is packed with 50 pieces/tube in tube packaging.

REFLOW SOLDERING



Parameter	Lead-free soldering conditions
Ave ramp up rate (T_L to T_P)	3°C/second max
Preheat time ts (T_{smin}=150°C to T_{smax}=200°C)	60-120 seconds
Melting time t_L (T_L=217°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
V2.0~V2.6	Product datasheet.	December 2020
V2.7	Updated test circuit and test condition; Updated SOP8 dimensions; Added tape and reel information; Added ordering information; Added reflow soldering information; Added important statement; Added revision history; Adjusted format.	November 2023