# Advanced-Failsafe, low slew-rate, +15kV ESD protection, 500Kbps rate transmission RS-485 Transceiver SP3085

Overview

The SP3085 is a high-speed transceiver for half-duplex communication for RS-485/RS-422 communication that contains a driver and a receiver.

The SP3085 has fail-safe circuit. The low slew rate driver reduces EMI and back-off due to improper termination matching cables and achieves up to 500Kbps Error-free data transmission. With 15kV ESD protection.

SP3085 are rated for industrial (-40 to +85ºC) operating temperatures. Receivers have exceptionally high input impedance, which places only 1/8th the standard load on a shared bus. Up to 256 transceivers may coexist while preserving full signal margin.

SOP-8

DIP-8
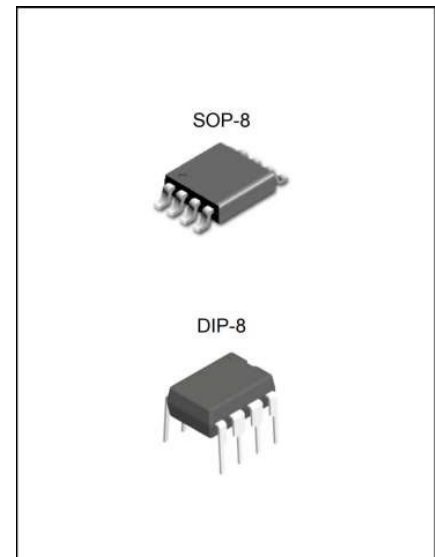
Features

- The I/O pins are protected against electrostatic discharge: $\pm$15kV HBM

  All other pins are protected against 3 levels of electrostatic discharge (ESD): $\pm$8kV HBM
- up to 256 devices on the bus
- +5V operating voltage
- With slope limiting function, the maximum data rate is 500Kbps
- Weak current shutdown mode operating current: 1nA
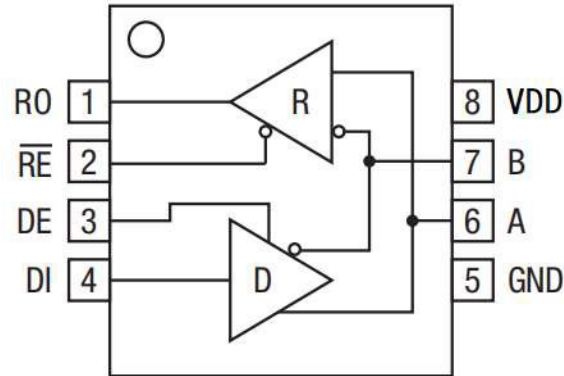- Current limiting and thermal shutdown for driver overload protection
- Package：SOP8, DIP8

Application

- RS485/RS422
- Industrial process control
- Building automation networks
- Motor control
- EMI sensitive transceiver applications

Ordering information

Type	Package	Packaging	MPQ
SP3085	SOP8	Reels	4000PCS

Block diagram

Pin description

Pins	Symbol	Function	attribute
1	RO	Receiver output: IF A-B ≥-0.05V, RO is high; IF A-B ≤-0.2V, RO is low; IF A and B are dangling or short, RO is also high.	O
2	$\overline{RE}$	Receiver output enable: WHEN $\overline{RE}$ is low, RO is enabled; When $\overline{RE}$ is high, RO is at high impedance.	I
3	DE	Driver output enable: Enable DE higher, the output of the driver, Y and Z, are enabled; they are at high impedance when DE are low.	I
4	DI	Driver input: DI is low, A is low, B is high; DI is high, A is high, B is low;	I
5	GND	Earth	
6	A	The input of the receiver and the output of the driver.	I/O
7	B	The input of the receiver and the output of the driver.	I/O
8	VDD	Power supply	

Function Tables

The SP3085 high speed half-duplex transceiver consists of a driver and receiver with a 1/8 unit load input impedance and up to 256 transceivers on the bus.

RECEIPT

Input			Output
$\overline{RE}$	DE	A - B	RO
L	X	≥-0.05V	H
L	X	≤-0.2V	L
L	X	Open/shorted	H
H	H	X	Z
H	L	X	Z

TRANSMISSION

Input			Output	
$\overline{RE}$	DE	DI	B	A
X	H	H	L	H
X	H	L	H	L
L	L	X	Z	Z
H	L	X	Z	

Absolute Maximum Ratings

Unless otherwise specified, $_{Tamb}$ = 25 °C

Parameter	Symbol	Value	Unit
Supply voltage	V_{DD}	-0.5~6	V
Limit input/output voltage	V_{IN}/V_{OUT}	GND- 0.3~V_{DD}+0.3	V
A/B limit input/output voltage	$V_{IN\,A/B}/V_{OUT\,A/B}$	-7~12	V
Operating ambient temperature	T_{amb}	-40~85	℃
Storage temperature	T_{stg}	-65~150	℃

DC electrical characteristics

(V_{CC} = 5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output (no load)	V_{OD1}					5	V
Differential Driver Output (with load)	V_{OD2}	R = 50Ω (RS-422) [1]		2			V
		R = 27Ω (RS-485) [1]		1.5		5	
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	ΔV_{OD}	R = 27Ω or 50Ω [1]				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R = 27Ω or 50Ω [1]			$V_{CC}/2$	3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OC}	R = 27Ω or 50Ω [1]				0.2	V
Input High Voltage	V_{IH1}	DE, DI, $\overline{RE}$		2.0			V
Input Low Voltage	V_{IL1}	DE, DI, $\overline{RE}$				0.8	V
Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2	µA
Input Current (A, B)	I_{IN2}	DE = 0V; V_{CC} = 0V or 5.25V,	V_{IN} = 12V			125	µA
			V_{IN} = -7V			-75	
Driver Output Short-Circuit Current	I_{OD1}	-7V≤V_{OUT}≤V_{DD}		-250			mA
		0V≤V_{OUT}≤12V				250	mA
		0V≤V_{OUT}≤V_{DD}		±25			mA

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤12V	-250		-10	mV
Receiver Input Hysteresis	ΔV_{TH}			25		mV
Receiver Output High Voltage	V_{OH}	Io = -4mA, V_{ID} = -50mV	3.5			V
Receiver Output Low Voltage	V_{OL}	Io = 4mA, V_{ID} = -200mV			0.4	V
Three-State (high impedance) Output Current at Receiver	I_{OZR}	0.4V ≤ Vo ≤ 2.4V			±1	µA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ 12V	96			kΩ
Receiver Short-Circuit Current	I_{OSR}	0V ≤ Vo ≤ V_{CC}		±80		mA

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
No-Load Supply Current	I_{CC}	No Load $\overline{RE}$=DI=GND or V_{DD}	DE = V_{DD}		480	800	µA
			DE=GND		450	700	µA

Transmission characteristics

Unless otherwise specified, V_{DD} = 5V　5% and $_{Tamb}$ = 25 °C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Features slope limiting						
Drive input to Output	t_{DPLH}	R_{DIFF}=50Ω, C_{L1}=C_{L2}=100pF[3][6]	250	720	1000	ns
Drive input to Output	t_{DPHL}	R_{DIFF}=50Ω, C_{L1}=C_{L2}=100pF[3][6]	250	720	1000	ns
$\|t_{DPLH}-t_{DPHL}\|$	t_{DSKEW}	R_{DIFF}=50Ω, C_{L1}=C_{L2}=100pF[3][6]		-3	±100	ns
Drive up and down Time	t_{DR},t_{DF}	R_{DIFF}=50Ω, C_{L1}=C_{L2}=100pF[3][6]	200	530	750	ns
Maximum data transfer rate	f_{MAX}			500		kbps
Drive enable delay	t_{DZH}	C_L=100pF,S2 CLOSED[4][7]			2500	ns
Drive enable delay	t_{DZL}	C_L=100pF,S1 CLOSED[4][7]			2500	ns
Drive shutdown delay	t_{DLZ}	C_L=15pF,S1 CLOSED[4][7]			100	ns
Drive shutdown delay	t_{DHZ}	C_L=15pF,S2 CLOSED[4][7]			100	ns
Receiver input and output Delay	t_{RPLH}	$\| V_{ID}\|$≥2.0V Rise and fall time ≤ 15ns[5][8]		127	200	ns
Receiver input and output Delay	t_{RPHL}			127	200	ns
$\|t_{RPLH}-t_{RPHL}\|$	t_{RSKD}	$\| V_{ID}\|$≥2.0V Rise and fall time ≤ 15ns[5][8]		3	±30	ns
Receiver enable delay	t_{RZL}	C_L=100pF,S1 CLOSED[2][9]		20	50	ns
Receiver enable delay	t_{RZH}	C_L=100pF,S2 CLOSED[2][9]		20	50	ns
Receiver shutdown delay	t_{RLZ}	C_L=100pF,S1 CLOSED[2][9]		20	50	ns
Receiver shutdown delay	t_{RHZ}	C_L=100pF,S2 CLOSED[2][9]		20	50	ns

Note:

(1) The test circuit is shown in Figure 1
(2) The test line is shown in Figure 2
(3) The test circuit is shown in Figure 3
(4) The test circuit is shown in Figure 4
(5) The test line is shown in Figure 5
(6) The test line is shown in Figure 6
(7) The test circuit is shown in Figure 7
(8) The test circuit is shown in Figure 8
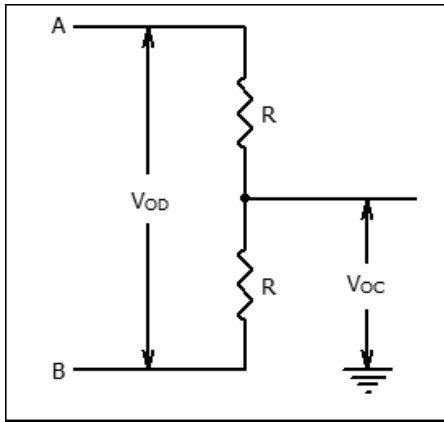(9) The test line is shown in Figure 9

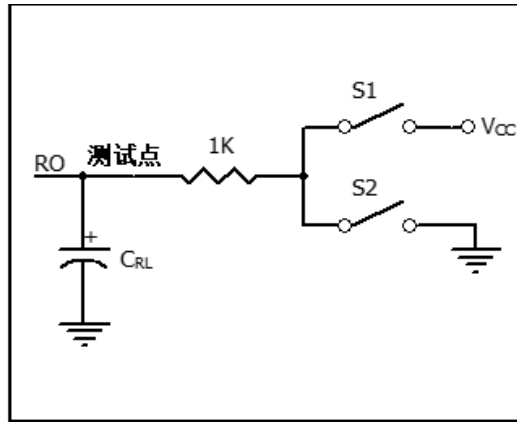## Test circuit

Figure1. Drive DC Test
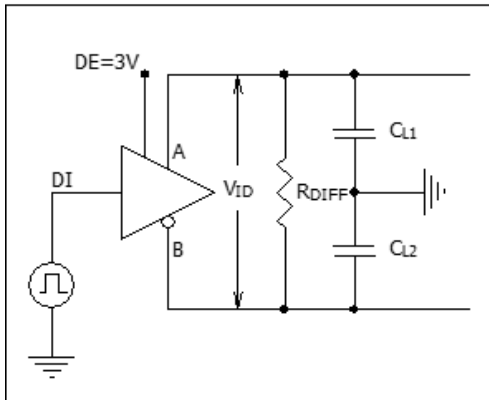

Figure 2. Receiver enable/OFF test
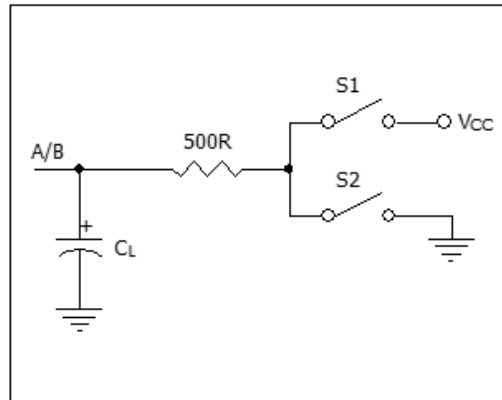

Figure3. Driver switch test

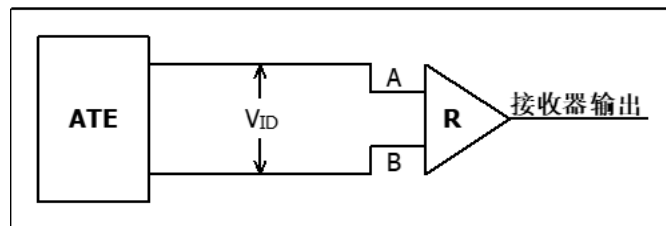Figure4. Driver enable/OFF test

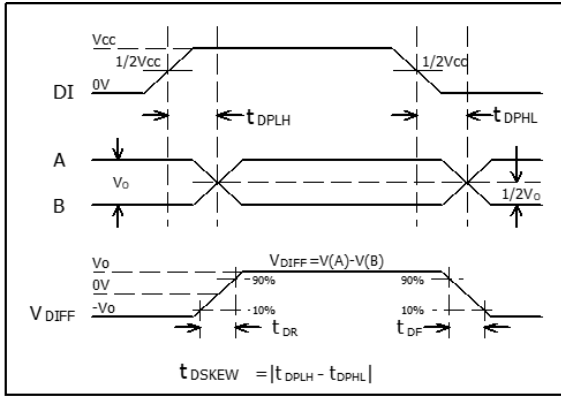Figure5. Receiver Delay Test Circuit

Switch wave

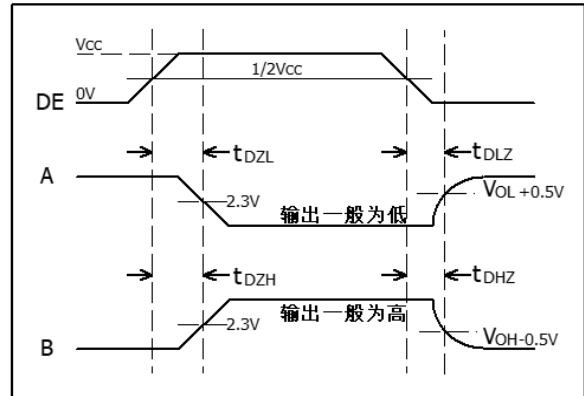Figure 6. Driver transmission delay

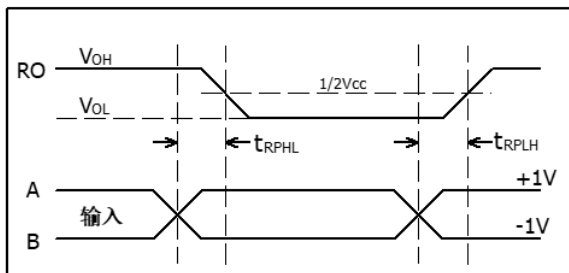
figure 7. Driver enable/OFF timing

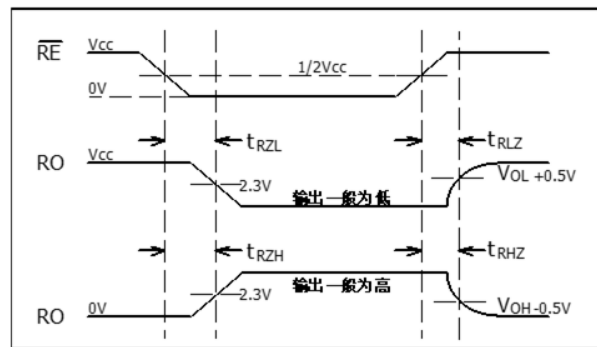Figure 8. Receiver transmission delay

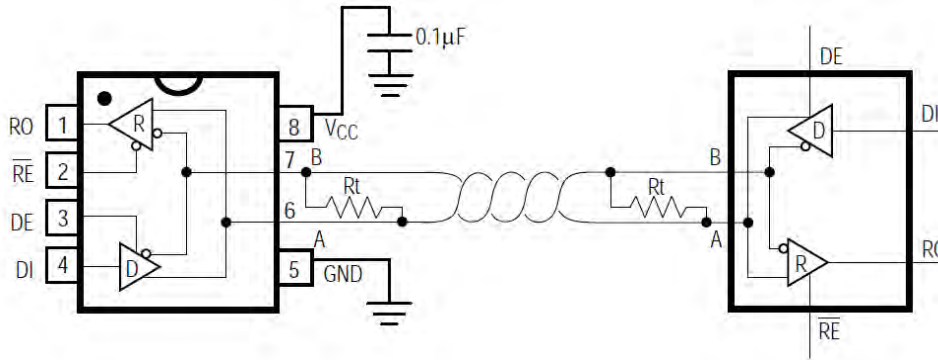figure 9. Receiver enable/OFF timing

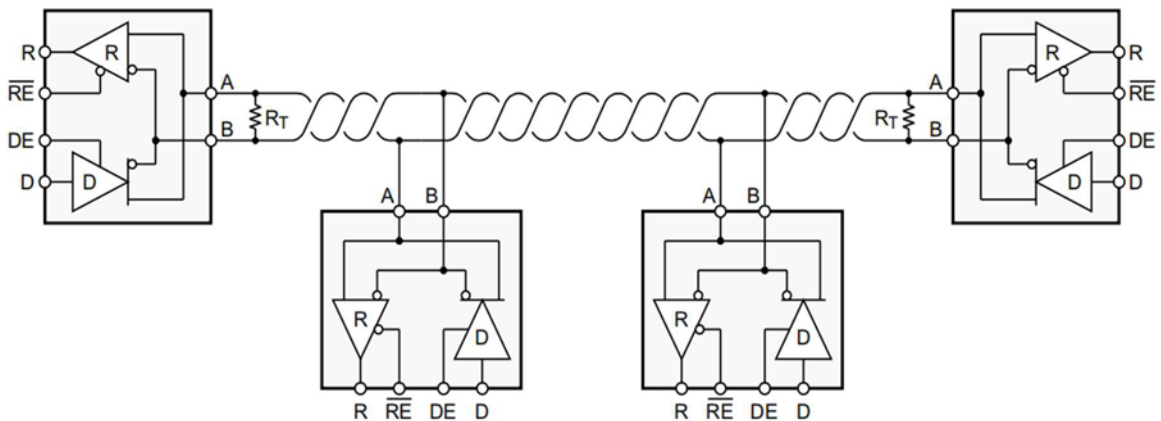## Typical application circuit

Figure 10Typical Application Diagram

Figure 11Typical Application Diagram

Transceivers are designed for bidirectional data communication on multi-point bus transmission lines. Figure 6 shows a typical network application power Road These devices can also be used as linear transponders with cable lengths longer than 4000 feet. In order to reduce reflection, terminal matching should be performed at both ends of the transmission line with their characteristic impedances, and the length of branch connections other than the trunk line should be as short as possible.
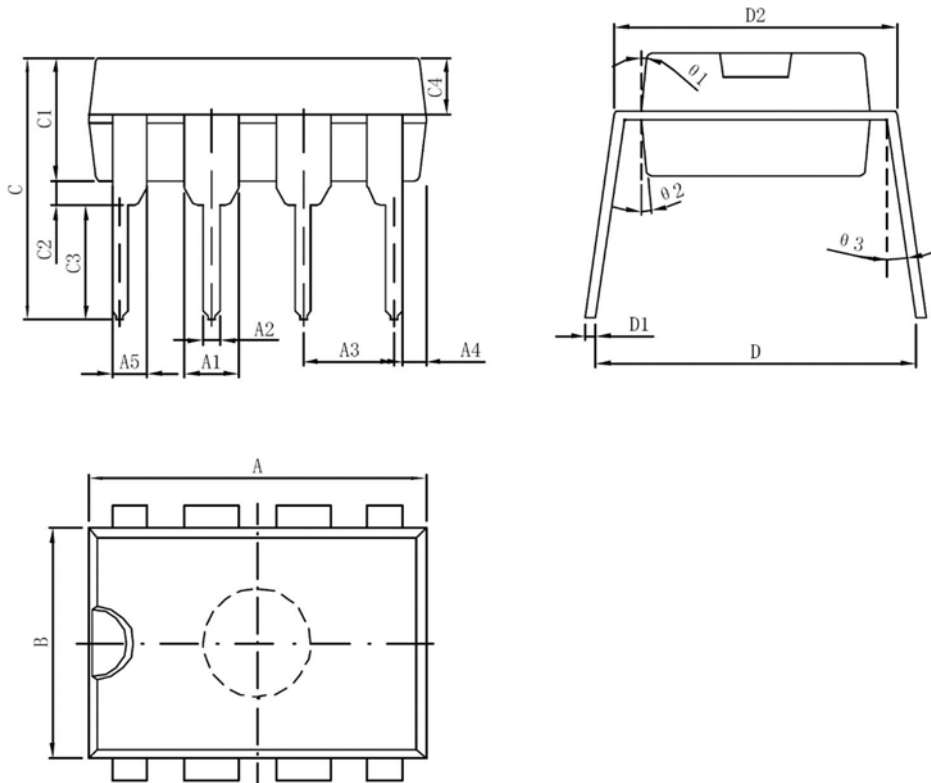
Package size (SOP8).

DETAIL "X"
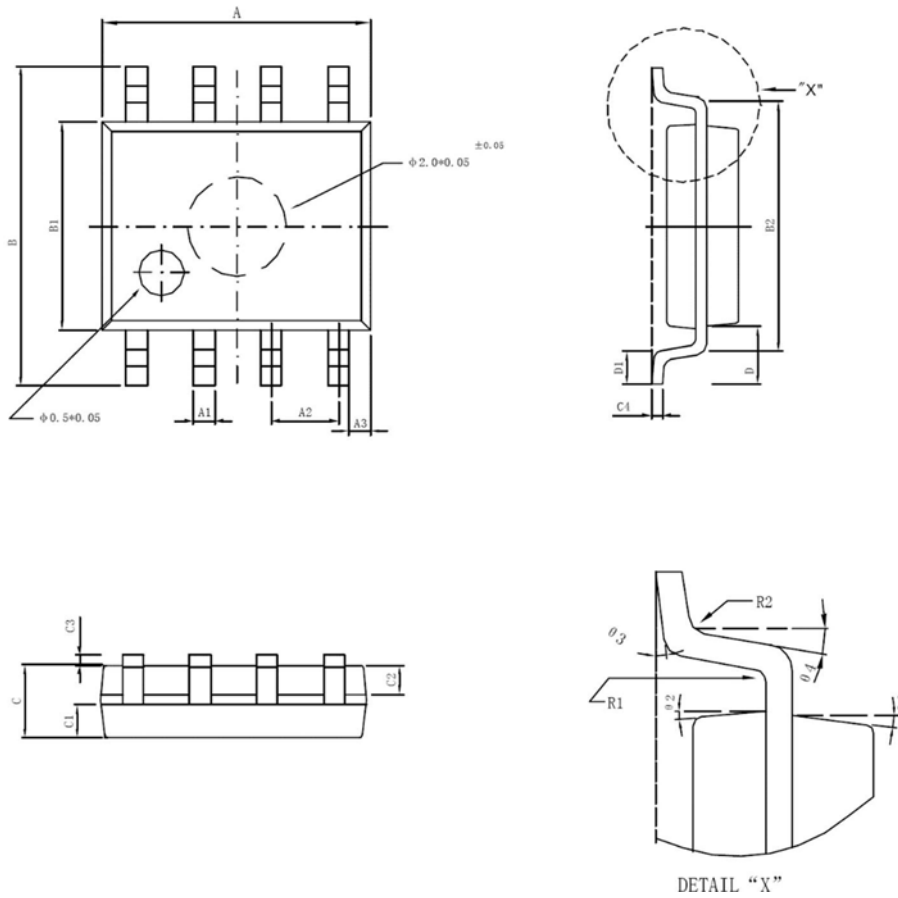
Marking	Min（mm）	Max（mm）	Marking	Min（mm）	Max（mm）
A	4.95	5.15	C3	0.10	0.20
A1	0.37	0.47	C4	0.20TYP	
A2	1.27TYP		D	1.05TYP	
A3	0.41TYP		D1	0.50TYP	
B	5.80	6.20	R1	0.07TYP	
B1	3.80	4.00	R2	0.07TYP	
B2	5.0TYP		θ1	17°TYP	
C	1.30	1.50	θ2	13°TYP	
C1	0.55	0.65	θ3	4°TYP	
C2	0.55	0.65	θ4	12°TYP	

Package size (DIP8)

Marking	Min（mm）	Max（mm）	Marking	Min（mm）	Max（mm）
A	9.30	9.50	C2	0.50	
A1	1.524		C3	3.3	
A2	0.39	0.53	C4	1.57TYP	
A3	2.54		D	8.20	8.80
A4	0.66TYP		D1	0.20	0.35
A5	0.99TYP		D2	7.62	7.87
B	6.3	6.5	θ1	8°TYP	
C	7.20		θ2	8°TYP	
C1	3.30	3.50	θ3	5°TYP	