

## To Our Customers

CEL continues to offer industry leading semiconductor products from Japan. We are pleased to add new communication products from THine Electronics to our product portfolio.

# THCS131

## I/O Spreader

### General Description

The THCS131 provides a function to serialize multiple parallel signals into single-ended serial line at least or to deserialize the data stream over single-ended serial line or single differential pair into multiple parallel signals.

This small number of transmission line simplifies system configuration and reduces system cost including cable width, connector size and pins and PCB layout area.

The THCS131 is offered in 8bit parallel IOs as host MPU interface.

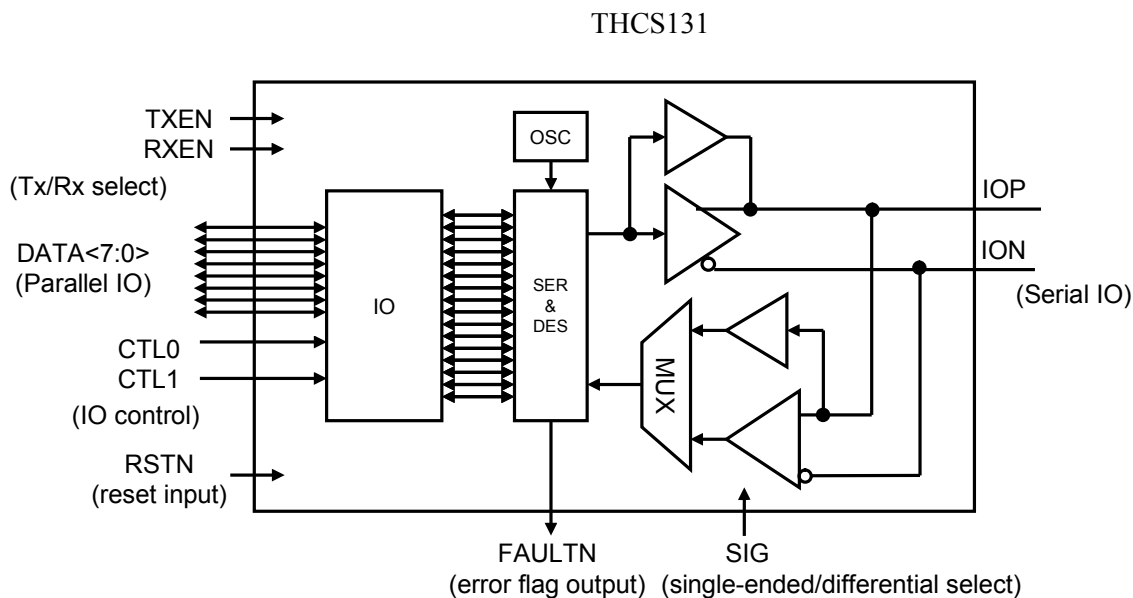
It can transfer 8bit independent parallel signals to remote side by only 1-line or 1-pair cable.

Transmitter or receiver function can be selected by pin options.

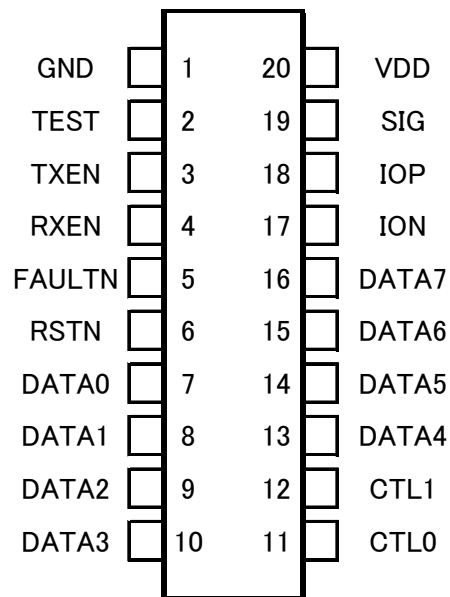
### Features

- No External Clock Required.
- 8bit Parallel IOs to MPU.
- Single-ended/Differential Mode (noise tolerant) Selectable
- AC Coupling Supported with Differential Mode
- Transmission Status Error Indicator Supported (Line Cut Detection and Packet Error Detection)
- Power supply : 3.0 to 5.5V
- DIP 20-pin Package
- EU RoHS Compliant

### Block Diagram



## Pin Diagram



## Pin Description

Pin No.	Pin Name	Internal Condition	Description
1	GND	-	Ground
2	TEST	Input, Pull-down	Test pin. Please connect to GND
3	TXEN	Input, Pull-down	Transmitter mode enable
4	RXEN	Input, Pull-down	Receiver mode enable
5	FAULTN	Output, Open-drain	Transmitter status error indicator Low : Abnormal operation detected
6	RSTN	Input, Pull-down	Reset input Low : Reset High : Normal operation
7-10 13-16	DATA0-7	Input/Output, Pull-up	Parallel data I/O bit : 0-7
11	CTL0	Input, Pull-up	Lower 8bit input latch (Transmitter mode) Lower 8bit Output enable (Receiver mode)
12	CTL1	Input, Pull-up	Upper 8bit input latch (Transmitter mode) Upper 8bit Output enable (Receiver mode)
17	ION	Input/Output	Serial data differential mode(-) I/O
18	IOP	Input/Output	Serial data CMOS/differential mode(+) I/O
19	SIG	Input, Pull-down	Serial data I/O mode select Low : CMOS High : Differential
20	VDD	-	Power Supply

**Absolute Maximum Rating**

Parameter	Condition	Min	Typ	Max	Unit
Power Supply Voltage VDD	-	-0.4	-	6	V
Digital Input Voltage (DATA0-DAT7, TXEN, RXEN, CTL0, CTL1, RSTN, SIG)	-	-0.4	-	6	V
Open-drain Output Pin(FAULTN)	-	-0.4	-	6	V
Allowable Power Dissipation	Ta=25°C	-	-	1	W
Storage Temperature	-	-55	-	150	°C
Junction Temperature	-	-	-	125	°C

**Recommended Operating Condition**

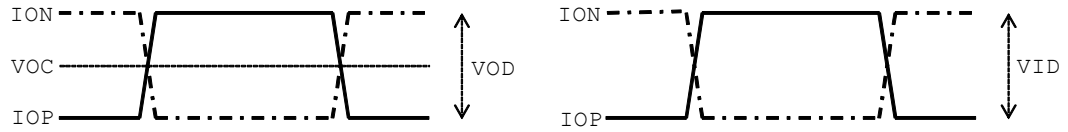
Parameter	Condition	Min	Typ	Max	Unit
Power Supply Voltage VDD	-	3.0	-	5.5	V
Ambient Operating Temperature	-	-40	-	85	°C

**Electrical Characteristic DC Characteristics** (at VDD=5.0V, Ta=25°C, unless otherwise noted)

Parameter	Condition	Min	Typ	Max	Unit
Power Supply Current	Transmitter mode				
	LVDS mode (Note)	-	20	30	mA
UVLO Threshold Voltage (VDD Rising)	-	-	2.6	2.8	V
UVLO Hysteresis Voltage	-	-	0.15	-	V
Digital Input High-level Voltage (VIH)	-	0.7VDD	-	-	V
Digital Input Low level Voltage (VIL)	-	-	-	0.3VDD	V
Digital Input Leakage Current 1	Except CTL1	-	-	+/-50	uA
Digital Input Leakage Current 2	CTL1	-	-	+/-150	uA
Digital Input Hysteresis Voltage	-	-	0.11VDD	-	V
Digital Output High-level Voltage (VOH)	VDD=3.0V Tj=125°C Iout=4mA	VDD-0.6	-	-	V
Digital Output High-level ON Resistance (RonH)	VDD=3.3V	-	56	-	Ohm
	VDD=5.0V	-	46	-	Ohm
Digital Output Low-level Voltage (VOL)	VDD=3.0V Tj=125°C Iout=4mA	-	-	0.4	V
Digital Output Low-level ON Resistance (RonL)	VDD=3.3V	-	44	-	Ohm
	VDD=5.0V	-	36	-	Ohm
Open Drain Output Low-level Voltage	Iout=1mA FAULTN	-	-	0.4	V
LVDS Differential Input Voltage (VID)	IOP/ION	200	-	-	mV
LVDS Input Leakage Current	IOP/ION	-	-	+/-50	uA
LVDS Differential Output Voltage (VOD)	VDD=3.0V IOP/ION	350	-	-	mV
	VDD=5.0V IOP/ION	-	600	-	mV
	VDD=5.5V IOP/ION	-	-	750	mV
LVDS Output Common-mode Voltage (VOC)	IOP/ION	1.0	1.25	1.4	V
Pull-down Resistance	-	-	250	-	kOhm
Pull-up Resistance	-	-	500	-	kOhm

Note: The power supply current is maximum in this condition.

LVDS Input Output Differential Voltage



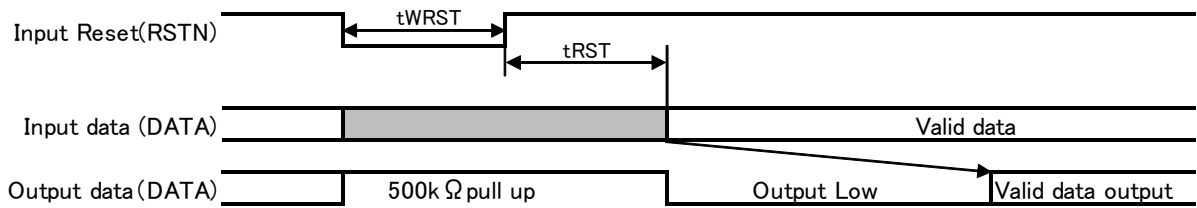
**Electrical Characteristic AC Characteristics (Reset Section)**

Mark	Parameter	Condition	Min	Typ	Max	Unit
tRST	Time from Reset (RSTN) Release to Valid Input	-	-	-	100 (Note)	us
tWRST	Reset (RSTN) Low Pulse Width	-	50	-	-	ns

Note : In AC coupling, tRST changes with the capacity to connect.

Timing Chart (Reset Section)

**Reset(RSTN) signal**



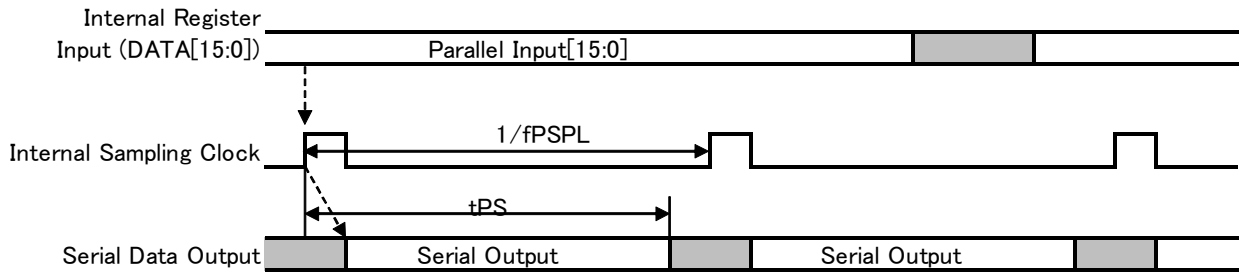
Output is controlled by signal of output enable (CTL0,CTL1).  
A pull-up state is continued until it sets signal of output enable to LOW.

**Electrical Characteristic AC Characteristics (Serial Communication)**

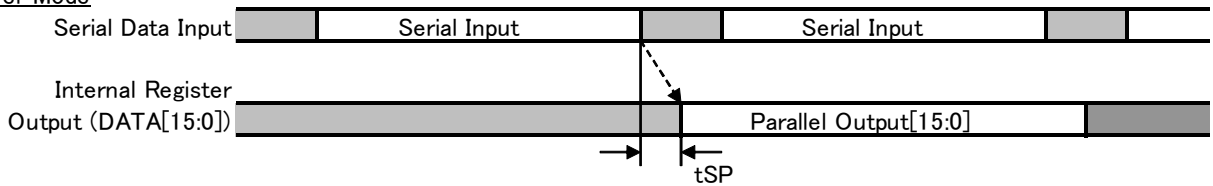
Mark	Item	Condition	Min	Typ	Max	Unit
fPSPL	Serializer Input Sampling Frequency	-	50	-	-	kHz
tPS	Time of Serializer Transmission	-	-	-	18	us
tSP	Deserializer Output Renewal Time	-	-	-	2	us
fSTR	Serial Data Transmission Rate	-	-	2.5	-	MHz

Timing Chart

Transmitter Mode



Receiver Mode



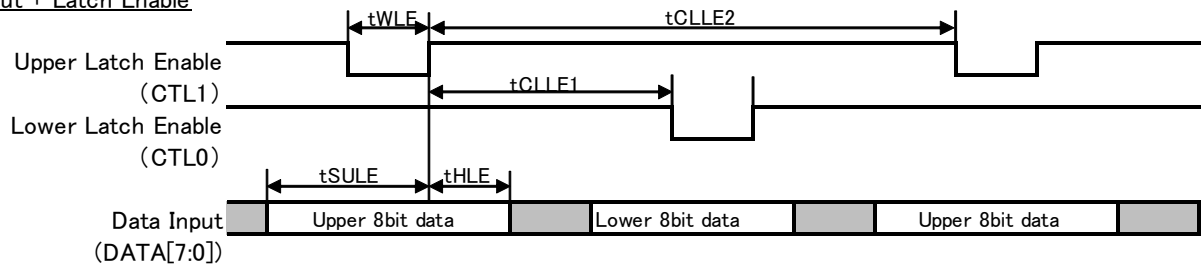
Internal sampling clock and CTL signals are asynchronous.

Electrical Characteristic AC Characteristics (Latch Enable, Output Enable)

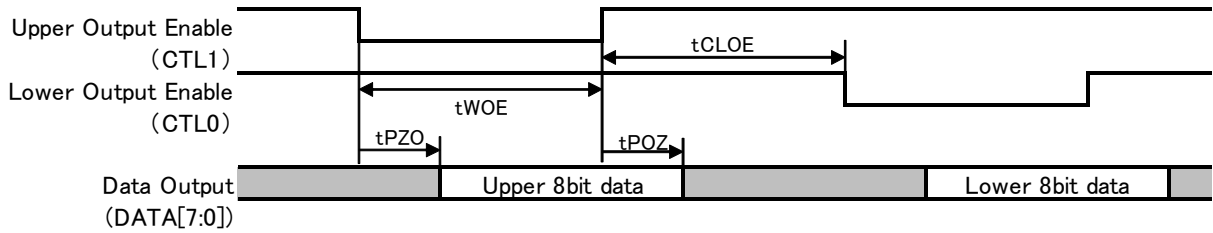
Symbol	Parameter	Condition	Min	Typ	Max	Unit
tWLE	Latch Enable Pulse Width	-	130	-	-	ns
tSULE	Latch Enable Rise Edge Setup Time	-	133	-	-	ns
tHLE	Latch Enable Rise Edge Hold Time	-	20	-	-	ns
tCLLE1	Latch Enable Clearance1	-	100	-	-	ns
tCLLE2	Latch Enable Clearance2	-	20	-	-	us
tWOE	Output Enable Pulse Width	-	50	-	-	ns
tCLOE	Output Enable Clearance	-	50	-	-	ns
tPZO	Output Enable Delay Time	CL=25pF	-	-	50	ns
tPOZ	Output Disable Delay Time	CL=25pF	-	-	38	ns

Timing Chart (Latch Enable, Output Enable)

8bit Input + Latch Enable



8bit Outout + Output Enable



When receiving new incoming data during CTL0 or CTL1 = Low, output data is updated to this new data.

• Latch Enable, Output Enable Truth Table

Transmitter mode

CTL1	CTL0	Latch Enable Input
L	L	Lower 8bit data is transmitted by sampling frequency (8bit through mode)
↑	H	Upper 8bit input latch
H	↑	Lower 8bit input latch and 16-bit data reception
H	H	Keep data

The rising edge of CTL0 is the trigger for sampling of upper and lower data.

Receiver mode

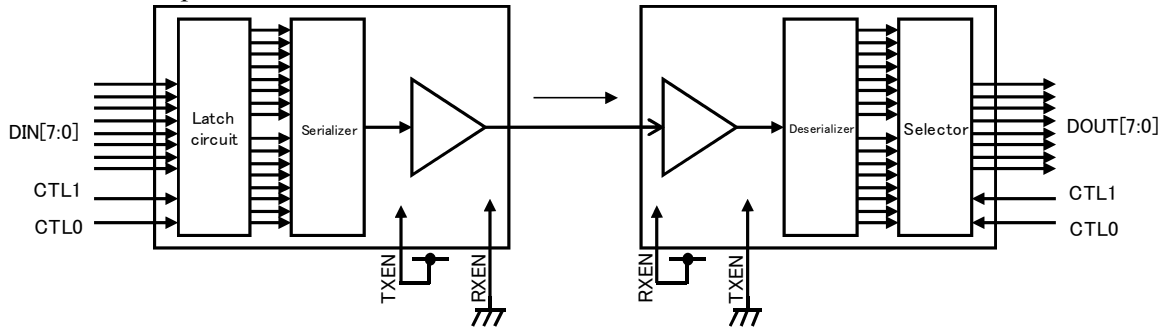
CTL1	CTL0	Output Enable Input
L	L	Output disable (DATA pins are pulled up by 500kΩ internally)
L	H	Upper 8bit Output enable
H	L	Lower 8bit Output enable
H	H	Output disable (DATA pins are pulled up by 500kΩ internally)

• Transmitter or Receiver select

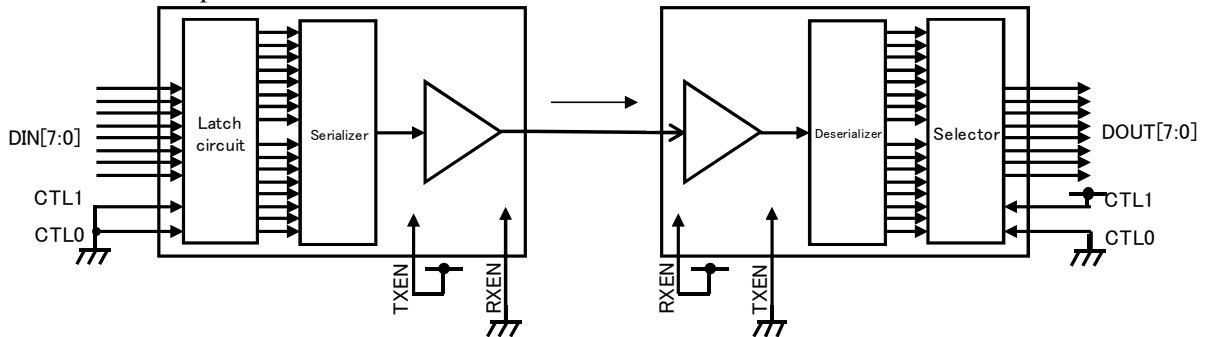
Pin		Description
TXEN	RXEN	
L	L	No function
L	H	Receiver mode (Serial to Parallel)
H	L	Transmitter mode (Parallel to Serial)
H	H	No function



• Connection Example (16-bit Transmitter and Receiver)



• Connection Example (8bit Transmitter and Receiver)



• Function Setup for Serial I/O Pins

IOP and ION pins are set as 1 lane CMOS I/O or 2-lane LVDS I/O with a SIG pin.

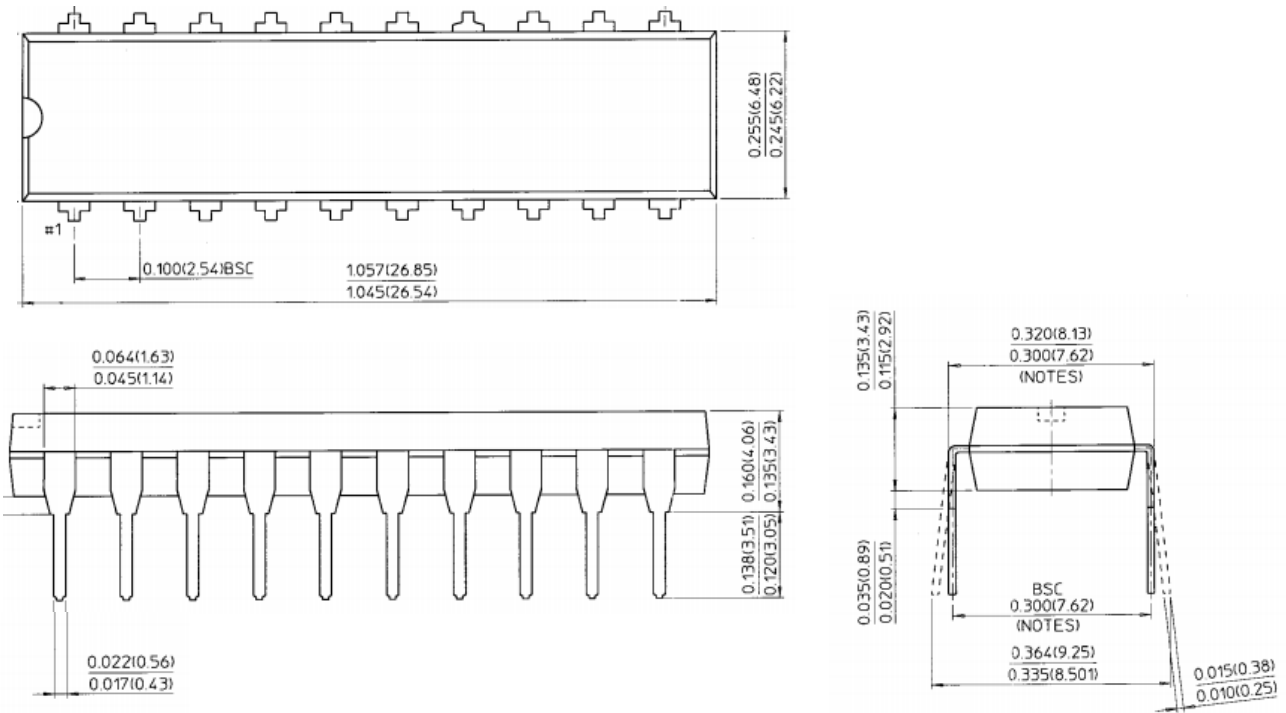
Pin Setup	Function		Description
	IOP	ION	
L	CMOS I/O	*	CMOS I/O
H	Differential mode I/O+	Differential mode I/O-	Differential mode I/O

\*: Please keep pin open (No connection)

• Function of Transmission Status Error Indicator, FAULTN (Receiver mode)

FAULTN is the output pin. When the protocol of received data is not correct or serial data more than 50usec (typ) is not received, FAULTN pin will be changed into low level. The received data is canceled when a FAULTN pin outputs Low. When normal serial data is received, a FAULTN pin outputs High in case of pulled up externally.

Package



Unit: inch (mm)

---

*Notices and Requests*

1. The product specifications described in this material are subject to change without prior notice.
2. The circuit diagrams described in this material are examples of the application which may not always apply to the customer's design. We are not responsible for possible errors and omissions in this material. Please note if errors or omissions should be found in this material, we may not be able to correct them immediately.
3. This material contains our copyright, know-how or other proprietary. Copying or disclosing to third parties the contents of this material without our prior permission is prohibited.
4. Note that if infringement of any third party's industrial ownership should occur by using this product, we will be exempted from the responsibility unless it directly relates to the production process or functions of the product.
5. This product is presumed to be used for general electric equipment, not for the applications which require very high reliability (including medical equipment directly concerning people's life, aerospace equipment, or nuclear control equipment). Also, when using this product for the equipment concerned with the control and safety of the transportation means, the traffic signal equipment, or various Types of safety equipment, please do it after applying appropriate measures to the product.
6. Despite our utmost efforts to improve the quality and reliability of the product, faults will occur with a certain small probability, which is inevitable to a semi-conductor product. Therefore, you are encouraged to have sufficiently redundant or error preventive design applied to the use of the product so as not to have our product cause any social or public damage.
7. Please note that this product is not designed to be radiation-proof.
8. Customers are asked, if required, to judge by themselves if this product falls under the category of strategic goods under the Foreign Exchange and Foreign Trade Control Law.
9. The product or peripheral parts may be damaged by a surge in voltage over the absolute maximum ratings or malfunction, if pins of the product are shorted by such as foreign substance. The damages may cause a smoking and ignition. Therefore, you are encouraged to implement safety measures by adding protection devices, such as fuses.

***THine Electronics, Inc.***

sales@thine.co.jp