



THCV2911B

V-by-One® HS Redriver with Linear Equalization

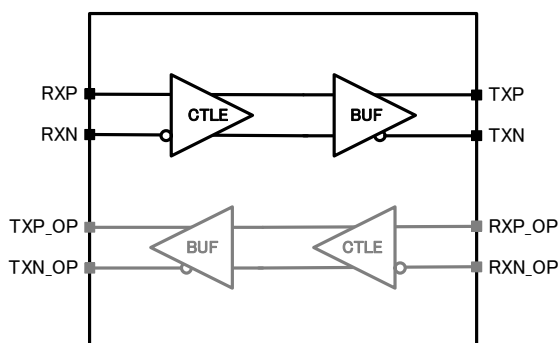
General Description

The THCV2911B is low power, high performance active redriver for V-by-One® HS with data rates up to 4Gbps. The THCV2911B pinout is configured as a forward and sub channels.

The THCV2911B features a powerful 18-stages continuous time linear equalizer (CTLE) to provide a boost of up to +10.6dB at 2GHz and open an input eye that is completely closed due to inter-symbol interference (ISI) induced by the inter-connect mediums such as cable or FR-4.

The programmable settings can be applied via pin configurations which eliminates the needs for an external microprocessor and software driver.

Block Diagram



Features

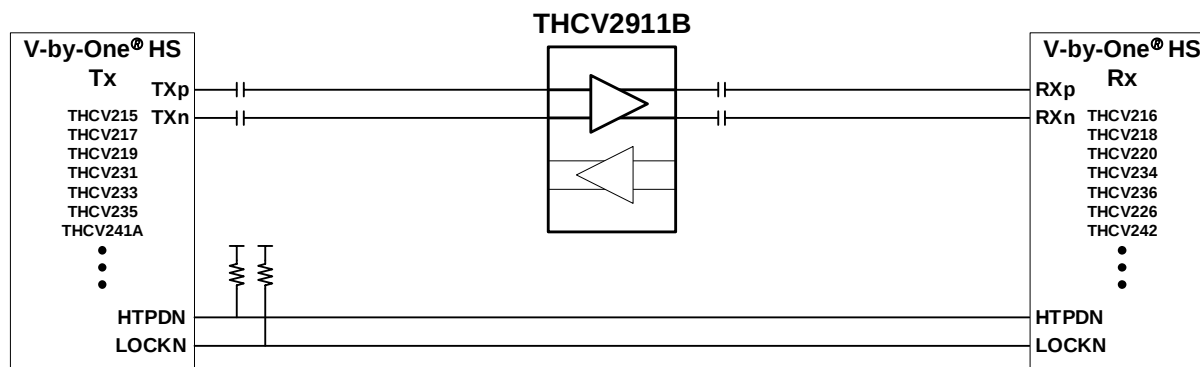
- Signal Conditioning with Linear Equalizer
- A forward and optional lane Redriver for up to 4 Gbps
- Linear Equalization up to +10.6dB@2GHz
- Adjustable Receiver Equalization and DC Gain
- Programmable via Pin Selection
- Flow-Thru Pinout
- Single Supply Voltage (3.3V)
- ESD HBM < ± 4 kV
- Package : QFN30 (2.5mm x 4.5mm)
- -40 to 105°C Operating Temperature

Applications

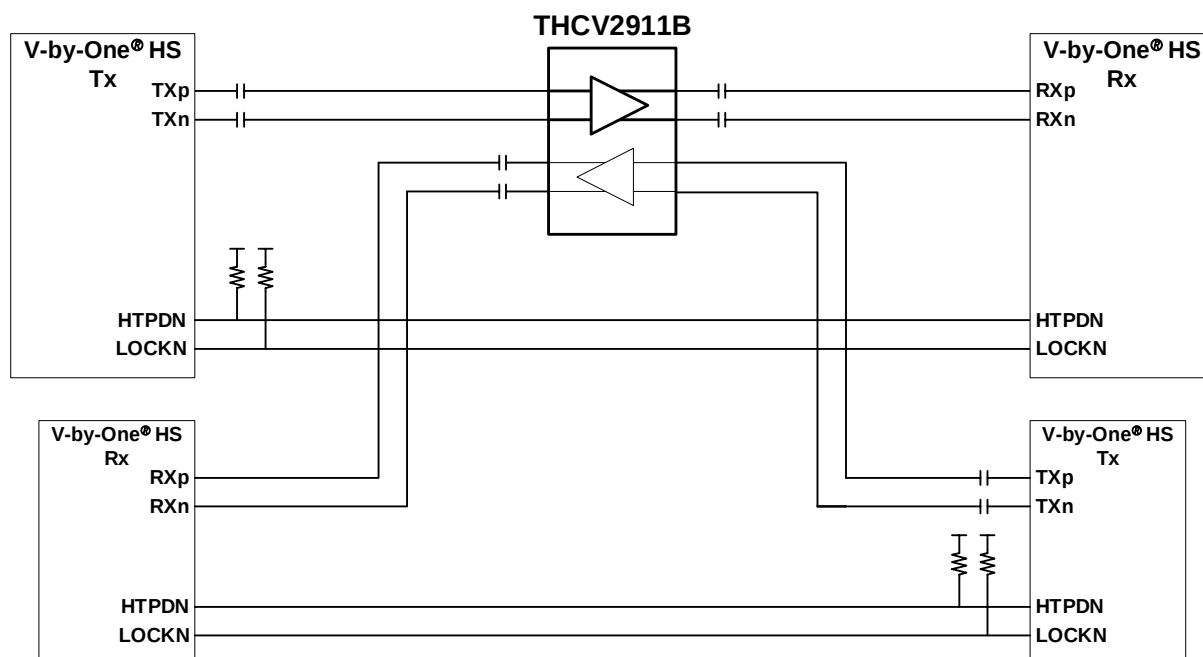
All V-by-One® HS applications for reach extension such as

- Digital Signage
- Digital blackboard
- Multi-Function Printer
- Production Printer
- Medical imaging
- Machine vision
- Image Sensor
- Camera
- Active Cable

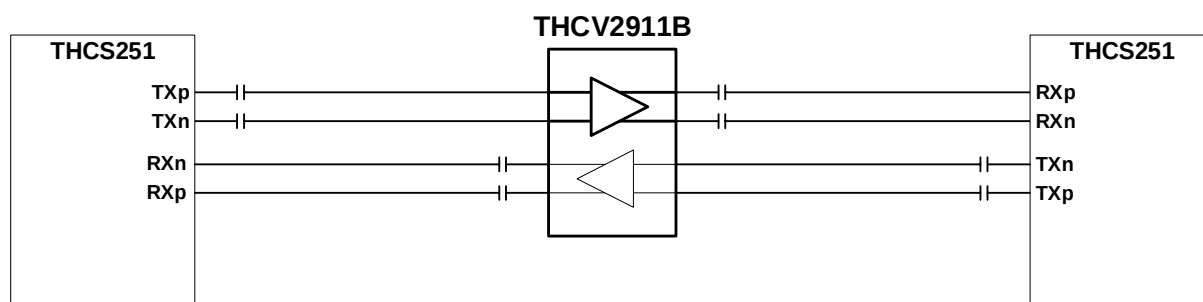
Typical Application



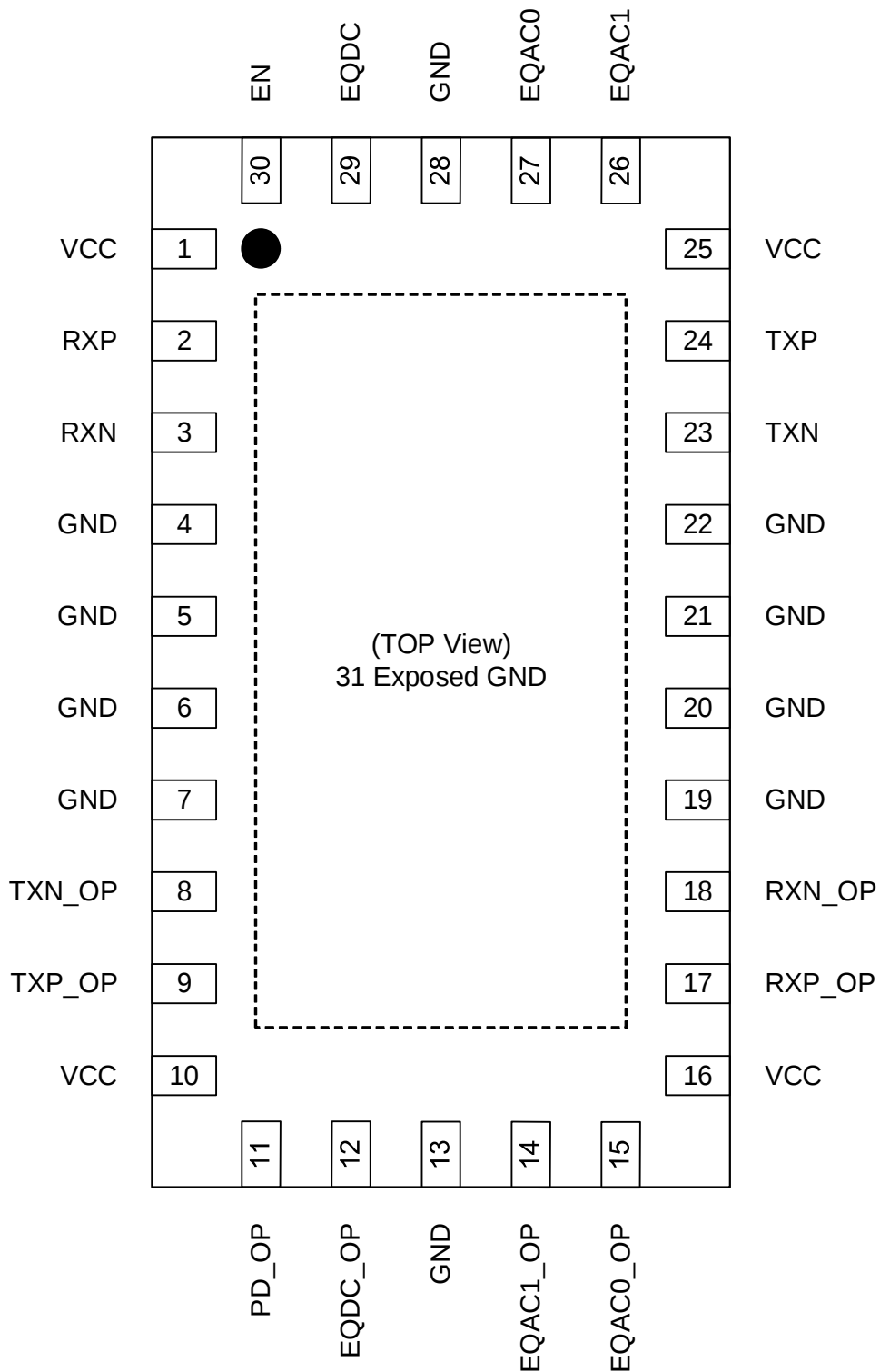
Optional Application



Optional Application with THCS251



Pin Configuration



Pin Description

Pin Name	Pin No	Type	Description
RXP	2	CI	High-Speed CML Signal Input of Main-Lane
RXN	3	CI	High-Speed CML Signal Input of Main-Lane
TXP	24	CO	High-Speed CML Signal Output of Main-Lane
TXN	23	CO	High-Speed CML Signal Output of Main-Lane
RXP_OP	17	CI	High-Speed CML Signal Input of Optional-Lane(OP)
RXN_OP	18	CI	High-Speed CML Signal Input of OP
TXP_OP	9	CO	High-Speed CML Signal Output of OP
TXN_OP	8	CO	High-Speed CML Signal Output of OP
EN	30	I	Channel Enable. 0 : Power Down 1 : Normal Operation
EQAC1	26	3LI (*1)	Main Rx Equalizer Peak Gain Setting This pin along with EQAC0 allows for up to 6 settings.
EQAC0	27	3LI (*1)	Main Rx Equalizer Peak Gain Setting This pin along with EQAC1 allows for up to 6 settings.
EQAC1_OP	14	3LI (*1)	OP Rx Equalizer Peak Gain Setting This pin along with EQAC0_OP allows for up to 6 settings.
EQAC0_OP	15	3LI (*1)	OP Rx Equalizer Peak Gain Setting This pin along with EQAC1_OP allows for up to 6 settings.
EQDC	29	3LI (*1)	Main Equalizer DC Gain Setting
EQDC_OP	12	3LI (*1)	OP Equalizer DC Gain Setting
PD_OP	11	3LI (*1)	Chip Operation Mode Select, if EN=1 F : OP Enable, 1 : OP Disable,
VCC	1, 10, 16, 25	PWR	Power Supply Pin for On-chip Regulator.
GND	4,5,6,7,13, 19,20,21, 22,28,31	GND	Ground. Must be tied to the PCB ground plane through an array of vias. Pin#31 is exposed pad ground.

CI: CML Input Buffer, CO: CML Output Buffer

I: LVCMOS Input Buffer, 3LI: 3-Level LVCMOS Input Buffer,

PWR: Power Supply, GND: Ground

*1 : 3-Level Input Buffer. With internal 180k Ω pull-up resistor and 300k Ω pull-down resistor.

Operation Mode Settings

Table 1. Operation Mode Settings

Pin Settings		Operation Mode
EN	PD_OP	
1	0(*1)	Reserved
	F(*2)	OP Enable
	1(*3)	OP Disable
0	Ignore	Chip Power Down.

*1 Tie 0Ω to GND

*2 Leave pin Open

*3 Tie 0Ω to VCC

Linear Equalizer Settings

Table 2. Linear Equalizer Settings

EQAC1(_OP)	EQAC0(_OP)	EQDC(_OP)	Equalizer Settings (dB)				
			Up to 0.1GHz	@0.5GHz (1Gbps)	@1.0GHz (2Gbps)	@1.5GHz (3Gbps)	@2.0GHz (4Gbps)
0	*	*	Reserved				
F	0	0	-0.9	0.2	0.8	1.2	1.6
F	F			0.5	1.7	2.7	3.7
F	1			0.6	2.1	3.5	4.8
1	0			0.8	2.4	4.0	5.5
1	F			1.3	3.7	5.9	7.9
1	1			1.5	4.2	6.6	8.8
F	0	F	1.6	2.6	3.1	3.4	3.5
F	F			2.8	3.7	4.4	5.1
F	1			2.9	4.1	5.0	6.0
1	0			3.0	4.3	5.4	6.6
1	F			3.4	5.2	6.9	8.6
1	1			3.5	5.6	7.5	9.4
F	0	1	5.7	6.5	6.8	6.9	6.8
F	F			6.6	7.2	7.5	7.9
F	1			6.7	7.4	7.8	8.3
1	0			6.7	7.5	8.1	8.7
1	F			6.9	8.0	9.1	10.2
1	1			7.0	8.2	9.5	10.6

Average of all channels in typical condition

Absolute Maximum Ratings

Table 3. Absolute Maximum Ratings

Parameter		Min	Typ	Max	Unit
Supply Voltage(VCC)		-0.3	-	4.0	V
LVCMOS Input/Output Voltage		-0.3	-	VCC+0.3	V
3-Level LVCMOS Input Voltage		-0.3	-	VCC+0.3	V
CML Receiver Input Voltage		-0.3	-	VCC+0.3	V
CML Transmitter Output Voltage		-0.3	-	VCC+0.3	V
ESD Rating	HBM	-	-	±4	kV
	CDM	-	-	±1000	V
Storage Temperature		-55	-	125	°C
Junction Temperature		-	-	125	°C
Reflow Peak Temperature/Time		-	-	260/10	°C/sec

Recommended Operating Conditions

Table 4. Recommended Operating Conditions

Parameter		Min	Typ	Max	Unit
Supply Voltage(VCC)		3.0	3.3	3.6	V
Supply Ramp Requirement		0.1	-	50	ms
Operating Temperature		-40	-	105 85(*1)	°C

(*1) PD_OP=F

Equivalent CML Input Schematic Diagram

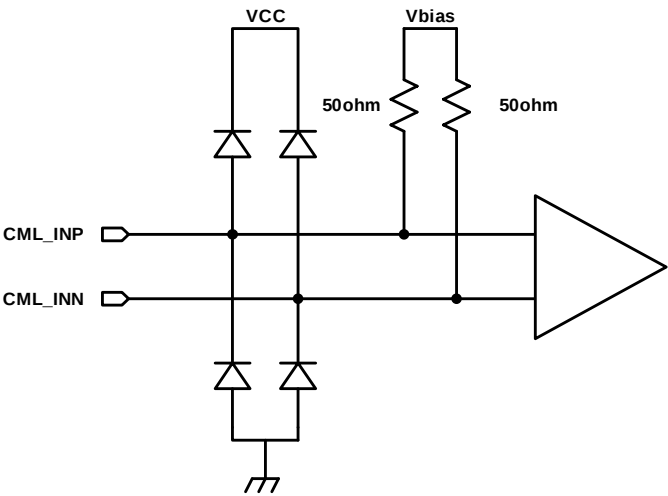


Figure 1. CML Input Schematic Diagram

Equivalent CML Output Schematic Diagram

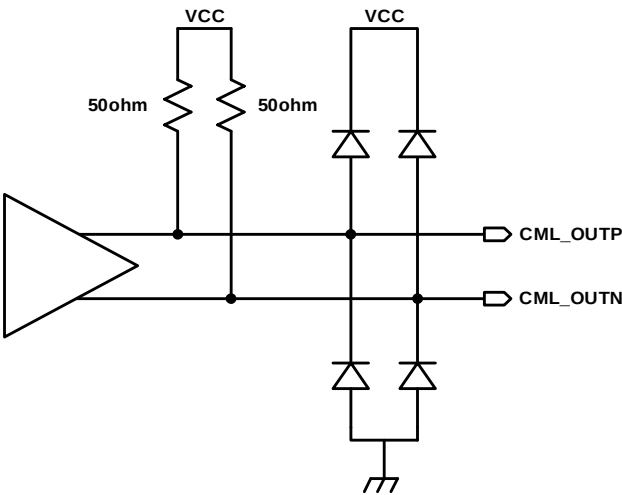
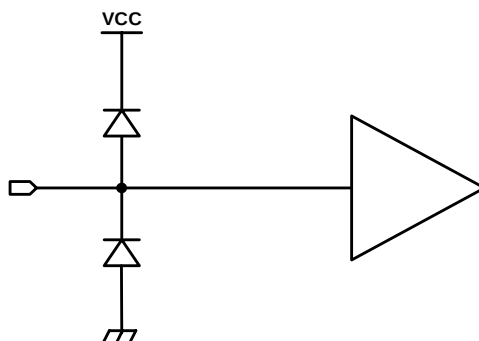
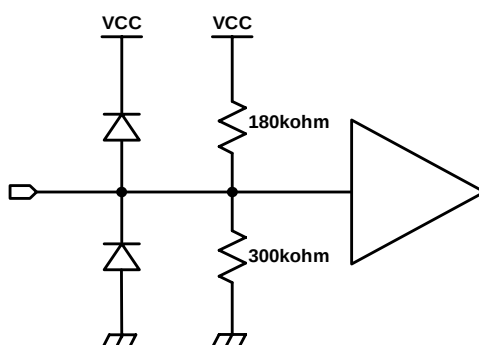


Figure 2. CML Output Schematic Diagram

Equivalent LVCMOS Input Schematic Diagram**Figure 3. LVCMOS Input Schematics Diagram****Equivalent 3-Level LVCMOS Input Schematic Diagram****Figure 4. 3-Level Input Schematics Diagram**

Electrical Specification

Supply Current

Table 5. Supply Current

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
ICCW	Active Mode Supply Current	PD_OP=1	-	58	84	mA
		PD_OP=F	-	84	106	mA
ICCS	Power Down Supply Current	-	-	120	180	uA

LVC MOS DC Specification

Table 6. LVC MOS DC Specification

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V _{IH}	High Level Input Voltage	-	2.0	-	VCC	V
V _{IL}	Low Level Input Voltage	-	0	-	0.7	V

3-Level LVC MOS DC Specification

Table 7. 3-Level LVC MOS DC Specification

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V _{THL}	Low Level Input Voltage	0(*1)	0	-	VCC*0.25 - 0.3	V
V _{THF}	F-Level Input Voltage	F(*2)	VCC*0.5 + 0.3	-	VCC*0.75 - 0.3	V
V _{THH}	High Level Input Voltage	1(*3)	VCC*0.75 + 0.3	-	VCC	V
I _{IH_3L}	High level Input Leak Current	VIN=VCC	-100	-	100	uA
I _{IL_3L}	Low Level Input Leak Current	VIN=GND	-100	-	100	uA

Receiver DC Specification

Table 8. Receiver DC Specification

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
VRTH	CML Differential Input High Threshold	-	-	-	50	mV
VRTL	CML Differential Input Low Threshold	-	-50	-	-	mV
IRIH	CML Input Leak Current High	EN=0,RXP/N=VCC	-10	-	10	uA
IRIL	CML Input Leak Current Low	EN=0,RXP/N=GND	-10	-	10	uA
RRIN	CML Differential Input Resistance	-	-	100	-	Ω

Transmitter DC Specifications

Table 9. Transmitter DC Specifications

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
VTOC	CML Common mode Output Voltage	-	-	VCC-0.75	-	V
ITOH	CML Output Leak Current High	EN=0	-	-	50	uA



AC Specifications

Table 10. AC Specification

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
T _{EN}	Power On to EN High Delay	-	0	-	-	ns
T _{ACTIVE}	EN High to Active Delay	-	-	-	200	us
T _{PROPAGATION}	Differential Propagation Delay	-	-	150	-	ps
ΔT _{PROPAGATION}	Delta Propagation Delay	-	-	-	40	ps

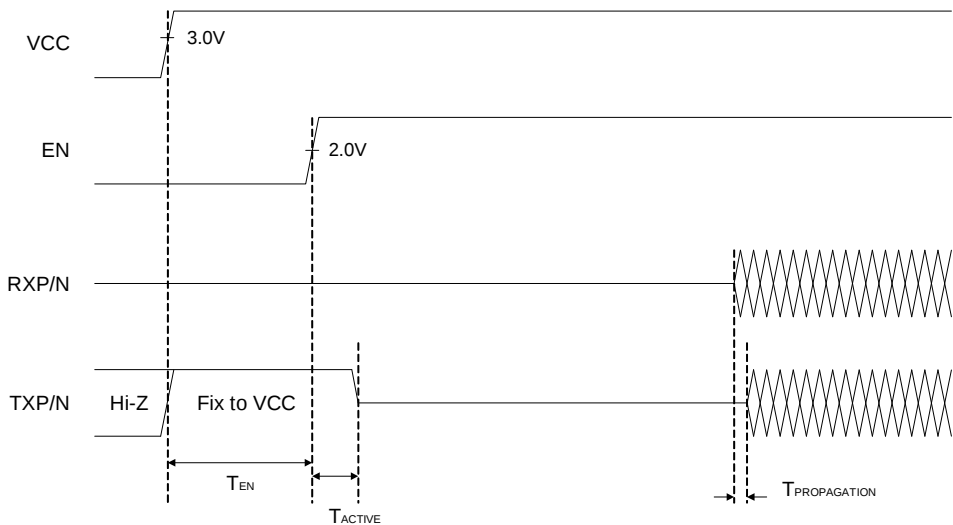


Figure 5. Power on Sequence

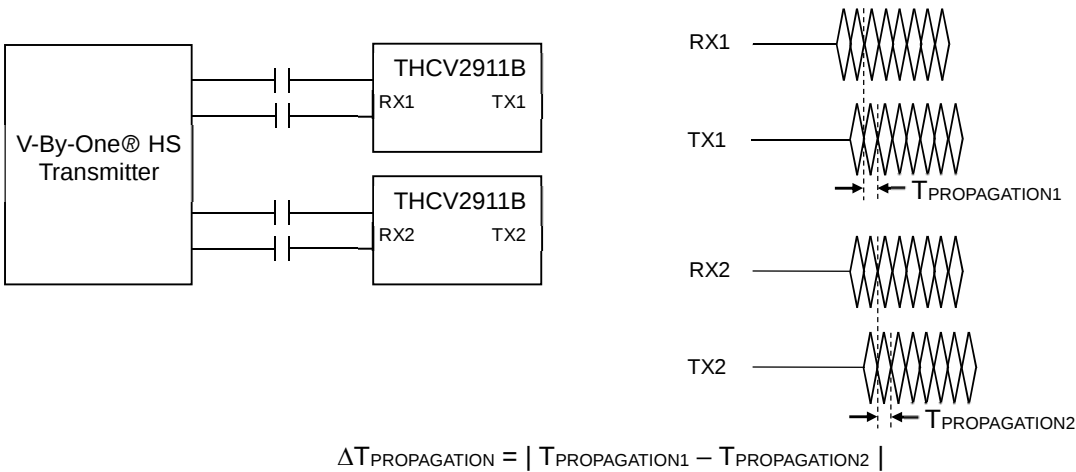


Figure 6. CML Propagation Delay Timing

Table 11. Transmitter AC Specification

Over recommended operating supply and temperature range unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
tTRF	Tx Rise/Fall Time	20% to 80 %	50	-	150	ps

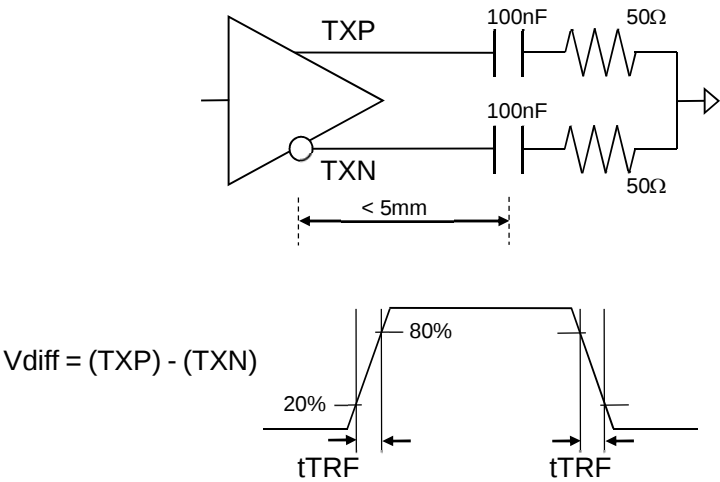
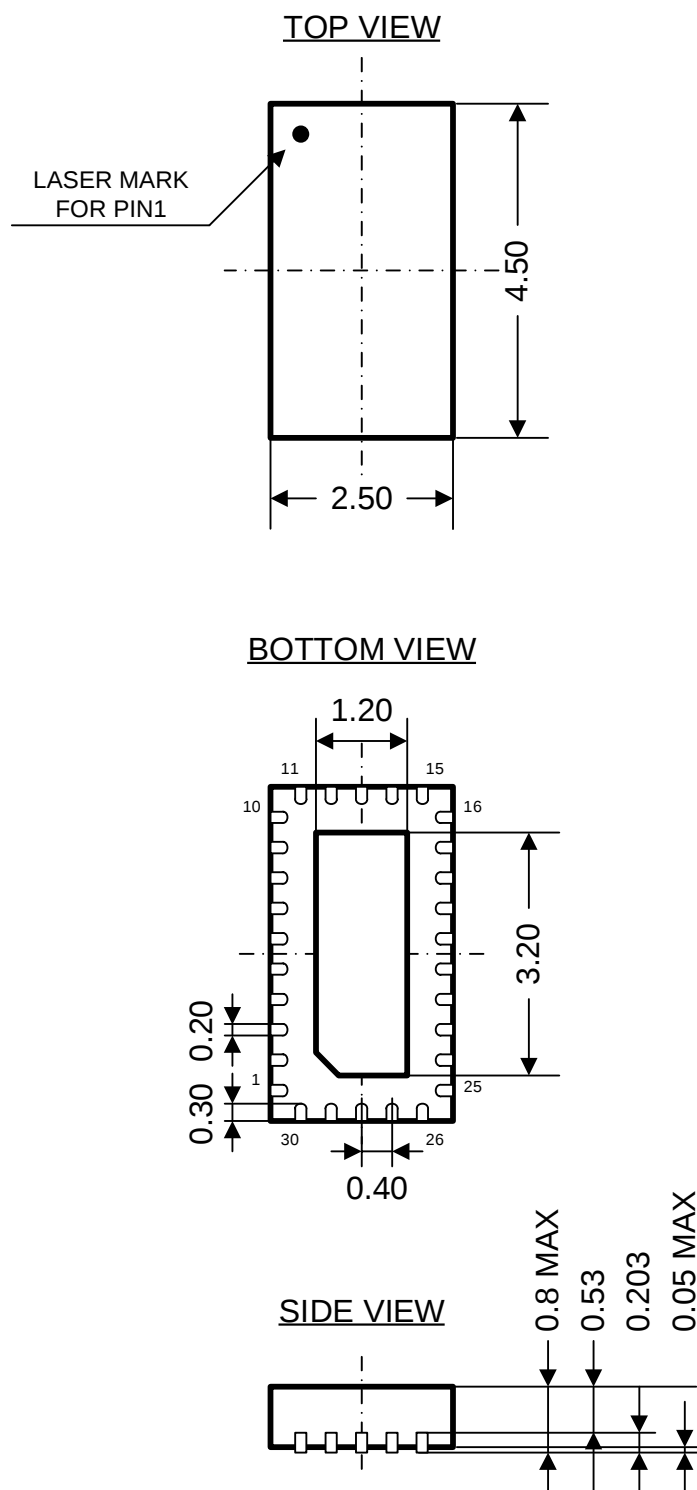


Figure 7. CML Output Switching Timing and Test Circuit

Package



Unit: 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. THine Electronics, Inc. ("THine") is not responsible for possible errors and omissions in this material. Please note even if errors or omissions should be found in this material, THine may not be able to correct them immediately.
3. This material contains THine's copyright, know-how or other intellectual property rights. Copying, reverse-engineer or disclosing to third parties the contents of this material without THine's prior written permission is prohibited.
4. THINE ACCEPTS NO LIABILITY FOR ANY DAMAGE OR LOSS IN CONNECTION WITH ANY DISPUTE RELATING TO INTELLECTUAL PROPERTY RIGHTS BETWEEN THE USER AND ANY THIRD PARTY, ARISING OUT OF THIS PRODUCT, EXCEPT FOR SUCH DAMAGE OR LOSS IN CONNECTION WITH DISPUTES SUCCESSFULLY PROVED BY THE USER THAT SUCH DISPUTES ARE DUE SOLELY TO THINE. NOTE, HOWEVER, EVEN IN THE AFOREMENTIONED CASE, THINE ACCEPTS NO LIABILITY FOR SUCH DAMAGE OR LOSS IF THE DISPUTE IS CAUSED BY THE USER'S INSTRUCTION.
5. This product is not designed for applications that require extremely high-reliability/safety such as aerospace device, nuclear power control device, or medical device related to critical care, excluding when this product is specified for automotive use by THine and used it for that purpose. THine accepts no liability whatsoever for any damages, claims or losses arising out of the uses set forth above.
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 fail-safe design principles such as 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. This product may be permanently damaged and suffer from performance degradation or loss of mechanical functionality if subjected to electrostatic charge exceeding capacity of the ESD (Electrostatic Discharge) protection circuitry. Safety earth ground must be provided to anything in contact with the product, including any operator, floor, tester and soldering iron.
8. Please note that this product is not designed to be radiation-proof.
9. Testing and other quality control techniques are used to this product to the extent THine deems necessary to support warranty for performance of this product. Except where mandated by applicable law or deemed necessary by THine based on the user's request, testing of all functions and performance of the product is not necessarily performed.
10. This product must be stored according to storage method which is specified in this specifications. THine accepts no liability whatsoever for any damage or loss caused to the user due to any storage not according to above-mentioned method.
11. 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 Act in Japan and the Export Administration Regulations in the United States of America on export or transit of this product. This product is prohibited for the purpose of developing military modernization, including the development of weapons of mass destruction (WMD), and the purpose of violating human rights.
12. 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 accepts no liability whatsoever for any damage or loss caused to the user due to use under a condition exceeding the limiting values.
13. All patents or pending patent applications, trademarks, copyrights, layout-design exploitation rights or other intellectual property rights concerned with this product belong to THine or licensor(s) of THine. No license or right is granted to the user for any intellectual property right or other proprietary right now or in the future owned by THine or THine's licensor. The user must enter into a license agreement with THine or THine's licensor to be granted of such license or right.

THine Electronics, Inc.

<https://www.thine.co.jp>