Multipoint-LVDS Line Driver and Receiver

Features

- Meets or Exceeds the M-LVDS Standard TIA/EIA-899 for Multipoint Data Interchange
- Low-Voltage Differential 30-Ω to 55-Ω Line Drivers and Receivers for Signaling Rates up to 250 Mbps, Clock Frequencies up to 150 MHz
- Type-2 Receivers Provide an Offset Threshold to Detect Open-Circuit and Idle-Bus
- Conditions
- −1 V to 3.4 V Common-Mode Voltage Range
- Allows Data Transfer with 2 V of Ground Noise
- Bus Pins High Impedance when Disabled or VCC ≤ 1.5 V
- Bus-Pin Protection: ±8 kV HBM model
- −40°C to 125°C Operation Temperature Range

Applications

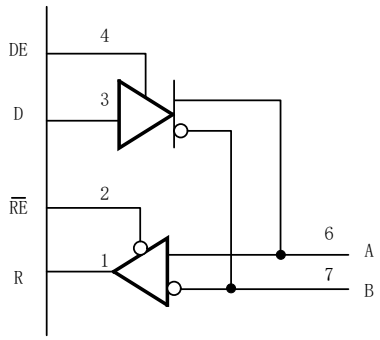
- Backplane Multipoint Data/Clock Transmission
- Cellular Base Stations
- Network Switches and Routers
- Industrial Control
- Communication Infrastructure

Description

The TPT9H2211 is a 3.3-V multipoint-low-voltage differential (M-LVDS) line driver and receiver, which can operate at signaling rates up to 250 Mbps. Driver outputs and receiver inputs are protected against ±8-kV ESD strikes without latch-up. The driver output is designed to support multipoint buses presenting loads as low as 30 Ω, and incorporates controlled transition times to allow for stubs off of the backbone transmission line.

The TPT9H2211 is a Type-2 receiver that can operate normally within a common-mode voltage range from -1 V to 3.4 V. Type-2 receivers include an offset threshold to provide a known output state under open-circuit, idle-bus, and other fault conditions. The device is characterized for operation from −40°C to 125°C. The device is available as half-duplex in the SOP8 package.

Typical Application Circuit



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Revision History

Date	Revision	Notes
2026-03-11	Rev.Pre.0	Initial version
2026-06-15	Rev.A.0	Released version

Pin Configuration and Functions

TPT9H2211
SOP8

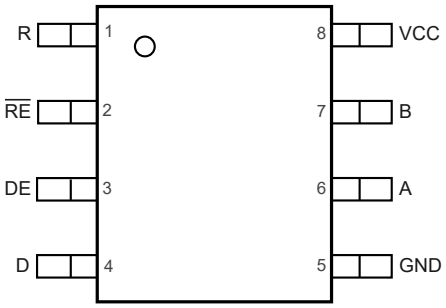


Table 1. Pin Functions

Pin No.	Name	I/O	Description
1	R	Digital O	Receiver output.
2	$\overline{RE}$	Digital I	Receiver output enable.
3	DE	Digital I	Driver output enable.
4	D	Digital I	Driver input.
5	GND	GND	Ground.
6	A	Bus I/O	Differential I/O
7	B	Bus I/O	Differential I/O
8	VCC	Power	Power supply.

Device Function Tables

Table 2. Truth Table Abbreviations

Abbreviation	Description
H	High level
L	Low level
X	Don't care
I	Indeterminate
Z	High impedance (off)
NC	Disconnected

Table 3. Driver

Input	Enable	Outputs	
D	**DE**	**A**	**B**
L	H	L	H
H	H	H	L
OPEN	H	L	H
X	OPEN	Z	Z
X	L	Z	Z

H = high level, L = low level, Z = high impedance, X = Don't care, ? = indeterminate

Table 4. Type-2 Receiver

Inputs		Output
$V_{ID} = V_A - V_B$	**RE**	**R**
$V_{ID} \geq 150$ mV	L	H
50 mV < V_{ID} < 150 mV	L	?
$V_{ID} \leq 50$ mV	L	L
X	H	Z
X	OPEN	Z
Open Circuit	L	L

Table 5. Type-2 Receiver Input Threshold Test Voltages

Applied Voltage		Differential Input Voltages	Common Mode Input Voltage	Receiver Output (1)
V_{IA}	**V_{IB}**	**V_{ID}**	**V_{IC}**	
2.400	0.000	2.400	1.200	H
0.000	2.400	–2.400	1.200	L
3.800	3.650	0.150	3.725	H
3.800	3.750	0.050	3.775	L

–1.250	–1.400	0.150	–1.325	H
–1.350	–1.400	0.050	–1.375	L

(1) H = high level, L = low level, output state assumes receiver is enabled (RE = L)

Specifications

Absolute Maximum Ratings (1)

Parameter		Min	Max	Unit
	V_{CC} to GND	−0.5	4	V
	Voltage at Logic Pin: D, DE, $\overline{RE}$, R	−0.3	4	V
	Voltage at Bus Pin: A, B	−1.8	4	V
T_J	Maximum Junction Temperature		150	°C
T_A	Operating Temperature Range	−40	125	°C
T_{STG}	Storage Temperature Range	−65	150	°C
T_L	Lead Temperature (Soldering, 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
$V_{(ESD)}$	Electrostatics Discharge (1)(2)	Contact discharge, per IEC 61000-4-2 on A, B	8	kV
		Human Body Model (HBM) on A, B	8	kV
		Human Body Model (HBM) on any other pins	4	kV
		ANSI/ESDA/JEDEC JS-002 (2)	1	kV

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SOP8	130		°C/W

(1) θ_{JA} = 130 °C/W is typical value of SOP8 provided by package assembly house.

Recommended Operating Conditions

Parameter		Min	Typ	Max	Unit
VCC	Supply Voltage	3	3.3	3.6	V
V_{IH}	High-Level Input Voltage	2		VCC	V
V_{IL}	Low-Level Input Voltage	GND		0.8	V
	Voltage at any Bus Terminal V_A, V_B	−1.4		3.8	V

Parameter		Min	Typ	Max	Unit
$\lvert V_{ID} \rvert$	Magnitude of Differential Input Voltage	0.05		VCC	V
T_A	Operating Free-Air Temperature	−40		125	°C

Electrical Characteristics

All test conditions: V_{CC} = 3.0 V to 3.6 V, T_A = −40℃ to 125℃, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Power Supply						
V_{CC}	Supply Voltage		3.0		3.6	V
I_{CC} Supply Current	Drive Only	RE and DE at V_{CC}, R_L = 50 Ω, all others open		13	22	mA
	Both Disabled	RE at V_{CC}, DE at 0 V, R_L = No Load, all others open		2	4	mA
	Both Enabled	RE at 0 V, DE at V_{CC}, R_L = 50 Ω, all others open		15	24	mA
	Receiver Only	RE at 0 V, DE at 0 V, R_L = 50 Ω, all others open		4	13	mA
Bus Input and Output						
I_A	Receiver or Transceiver with Driver Disabled Input Current	V_A = 3.8 V, V_B = 1.2 V	0		32	μA
		V_A = 0 V or 2.4 V, V_B = 1.2 V	−20		20	μA
		V_A = −1.4 V, V_B = 1.2 V	−32		0	μA
I_B	Receiver or Transceiver with Driver Disabled Input Current	V_B = 3.8 V, V_A = 1.2 V	0		32	μA
		V_B = 0 V or 2.4 V, V_A = 1.2 V	−20		20	μA
		V_B = −1.4 V, V_A = 1.2 V	−32		0	μA
I_{AB}	Receiver or Transceiver with Driver Disabled Differential Input Current (I_A − I_B)	V_A = V_B, 1.4 ≤ V_A ≤ 3.8 V	−4		4	μA
$I_{A\ (OFF)}$	Receiver or Transceiver Power-off Input Current	V_A = 3.8 V, V_B = 1.2 V, 0 V ≤ V_{CC} ≤ 1.5 V	0		32	μA
		V_A = 0 V or 2.4 V, V_B = 1.2 V, 0 V ≤ V_{CC} ≤ 1.5 V	−20		20	μA
		V_A = −1.4 V, V_B = 1.2 V, 0 V ≤ V_{CC} ≤ 1.5 V	−32		0	μA
$I_{B\ (OFF)}$	Receiver or Transceiver Power-off Input Current	V_B = 3.8 V, V_A = 1.2 V, 0 V ≤ V_{CC} ≤ 1.5 V	0		32	μA
		V_B = 0 V or 2.4 V, V_A = 1.2 V, 0 V ≤ V_{CC} ≤ 1.5 V	−20		20	μA
		V_B = −1.4 V, V_A = 1.2 V, 0 V ≤ V_{CC} ≤ 1.5 V	−32		0	μA
$I_{AB\ (OFF)}$	Receiver Input or Transceiver Power-off Differential Input Current (I_A − I_B)	V_A = V_B, 0 V ≤ V_{CC} ≤ 1.5 V, −1.4 ≤ V_A ≤ 3.8 V	−4		4	μA
C_A or C_B	Input Capacitance (1)			15		pF
C_{AB}	Differential Input Capacitance (1)			3		pF

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{A/B}$	Input Capacitance Balance, (C_A /C_B) (1)		0.99		1.01	
Driver Electrical Characteristics						
$\|V_{AB}\|$	Differential Output Voltage Magnitude	See Figure 2	480		650	mV
$\Delta\|V_{AB}\|$	Change in Differential Output Voltage Magnitude Between Logic States		−50		50	mV
$V_{OS\ (SS)}$	Steady-State Common-Mode Output Voltage	See Figure 3	0.8		1.2	V
$\Delta V_{OS\ (SS)}$	Change in Steady-State Common-Mode Output Voltage Between Logic States		−50		50	mV
$V_{OS\ (PP)}$	Peak-to-Peak Common-Mode Output Voltage			75		mV
$V_{A\ (OC)}$	Maximum Steady-State Open-Circuit Output Voltage	See Figure 7	0		2.4	V
$V_{B\ (OC)}$	Maximum Steady-State Open-Circuit Output Voltage		0		2.4	V
$V_{P\ (H)}$	Voltage Overshoot, Low-to-High Level Output	See Figure 5			1.2 V_{SS}	V
$V_{P\ (L)}$	Voltage Overshoot, High-to-Low Level Output		−0.2 V_{SS}			V
I_{IH}	High-Level Input Current (D, DE)	V_{IH} = 2 V to VCC	0		10	μA
I_{IL}	Low-Level Input Current (D, DE)	V_{IL} = GND to 0.8 V	0		10	μA
$\|I_{OS}\|$	Differential Short-Circuit Output Current Magnitude	See Figure 4			24	mA
Driver Switching Characteristics						
t_{PLH}	Propagation Delay Time, Low-to-High-Level Output (1)	See Figure 5	1.3	2.8	4.7	ns
t_{PHL}	Propagation Delay Time, High-to-Low-Level Output (1)		1.3	2.8	4.7	ns
t_r	Differential Output Signal Rise Time (1)			1.3	2.2	ns
t_f	Differential Output Signal Fall Time (1)			1.3	2.2	ns
$t_{sk\ (p)}$	Pulse Skew ($\|t_{PHL} - t_{PLH}\|$) (1)				150	ps
$t_{jit\ (per)}$	Period Jitter, rms (1 Standard Deviation) (1)	100-MHz clock input		1		ps
t_{PHZ}	Disable Time, High-Level-to-High-Impedance Output (1)	See Figure 6			7.6	ns
t_{PLZ}	Disable Time, Low-Level-to-High-Impedance Output (1)				8.3	ns

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PZH}	Enable Time, High-Impedance-to-High-Level Output (1)				7.2	ns
t_{PZL}	Enable Time, High-Impedance-to-Low-Level Output (1)				7.2	ns
Receiver Electrical Characteristics						
V_{IT+}	Positive-Going Differential Input Voltage Threshold	See Figure 9 , Table 2 and Table 3			150	mV
V_{IT-}	Negative-Going Differential Input Voltage Threshold		50			mV
V_{HYS}	Differential Input Voltage Hysteresis, (V_{IT+} − V_{IT}) (1)			0		mV
V_{OH}	High-Level Output Voltage	I_{OH} = −8 mA	2.4			V
V_{OL}	Low-Level Output Voltage	I_{OL} = 8 mA			0.4	V
I_{IH}	High-Level Input Current (RE)	V_{IH} = 2 V to VCC	–10		0	μA
I_{IL}	Low-Level Input Current (RE)	V_{IL} = GND to 0.8 V	–10		0	μA
IOZ	High−impedance state output current	VCC = 0 V or 3.6 V	-10		15	μA
Receiver Switching Characteristics						
t_{pLH}	Propagation Delay Time, Low-to-High-Level Output (1)	C_L = 15 pF, See Figure 10	2	4	7	ns
t_{pHL}	Propagation Delay Time, High-to-Low-Level Output (1)		2	4	7	ns
t_r	Output Signal Rise Time			0.9	2.3	ns
t_f	Output Signal Fall Time			0.8	2.3	ns
$t_{sk\ (p)}$	Pulse Skew ($\|t_{pHL} - t_{pLH}\|$)(1)			260		ps
$t_{jit\ (per)}$	Period Jitter, rms (1 Standard Deviation) (1)	100-MHz clock input		2.5		ps
t_{pHZ}	Disable Time, High-Level-to-High-Impedance Output (1)	See Figure 11		4	6	ns
t_{pLZ}	Disable Time, Low-Level-to-High-Impedance Output (1)			4	6	ns
t_{pZH}	Enable Time, High-Impedance-to-High-Level Output (1)			12	20	ns
t_{pZL}	Enable Time, High-Impedance-to-Low-Level Output (1)			12	20	ns

(1) The test data based on bench test and design simulation, can NOT test in production.

Test Circuits, Configurations and Waveforms

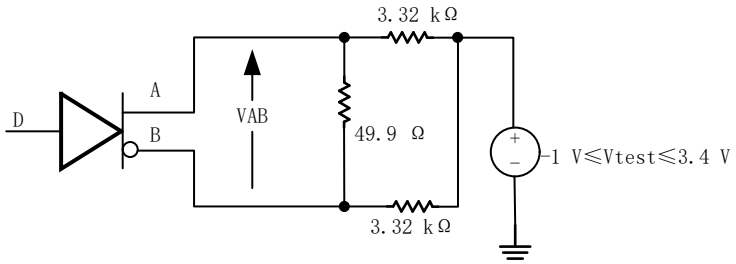


Figure 1. Driver Voltage and Current Definitions

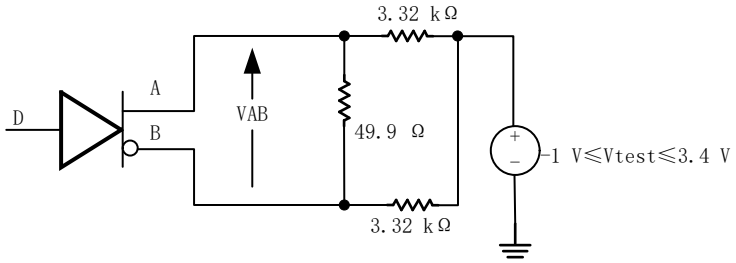


Figure 2. Differential Output Voltage Test Circuit

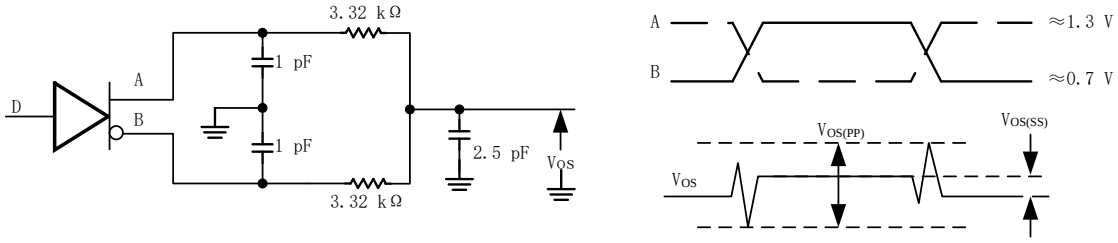


Figure 3. Test Circuit and Definitions for the Driver Common-Mode Output Voltage

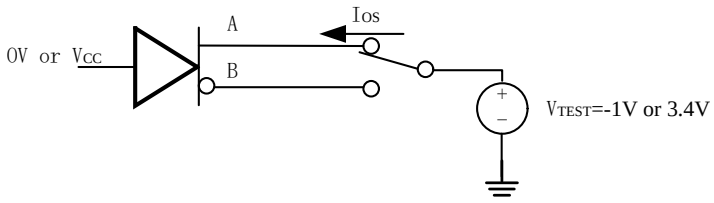


Figure 4. Driver Short-Circuit Test Circuit

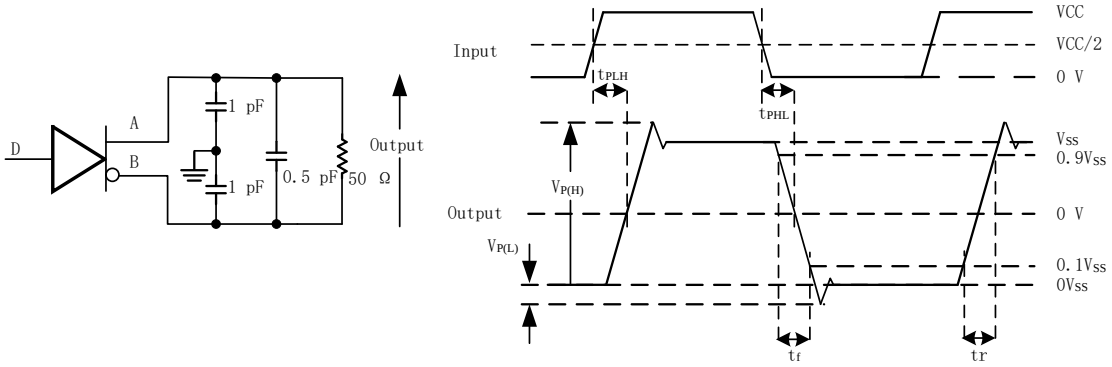


Figure 5. Driver Test Circuit, Timing, and Voltage Definitions for the Differential Output Signal

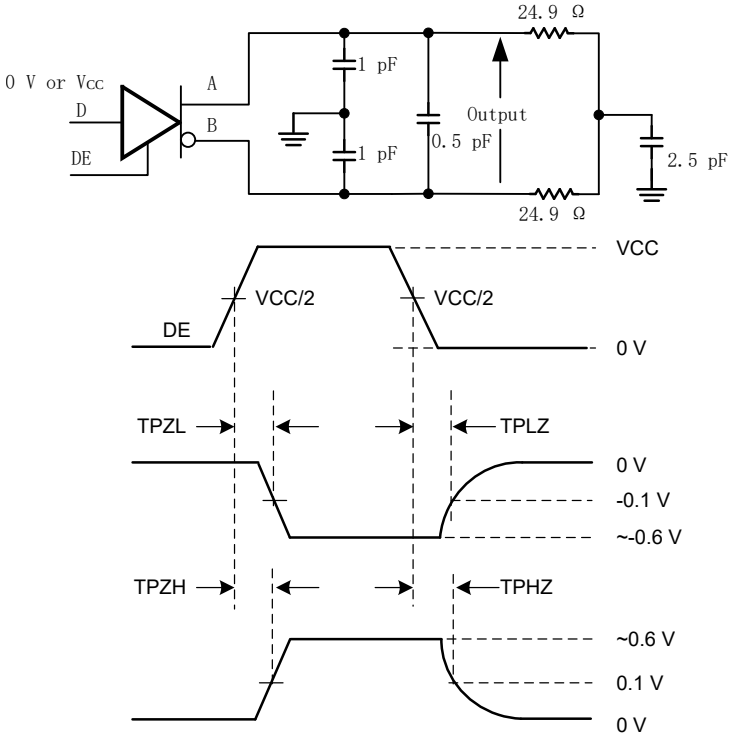


Figure 6. Driver Enable and Disable Time Circuit and Definitions

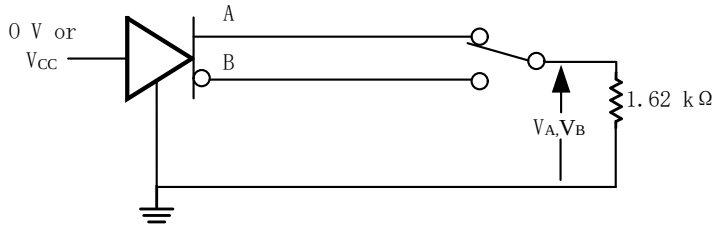


Figure 7. Maximum Steady State Output Voltage

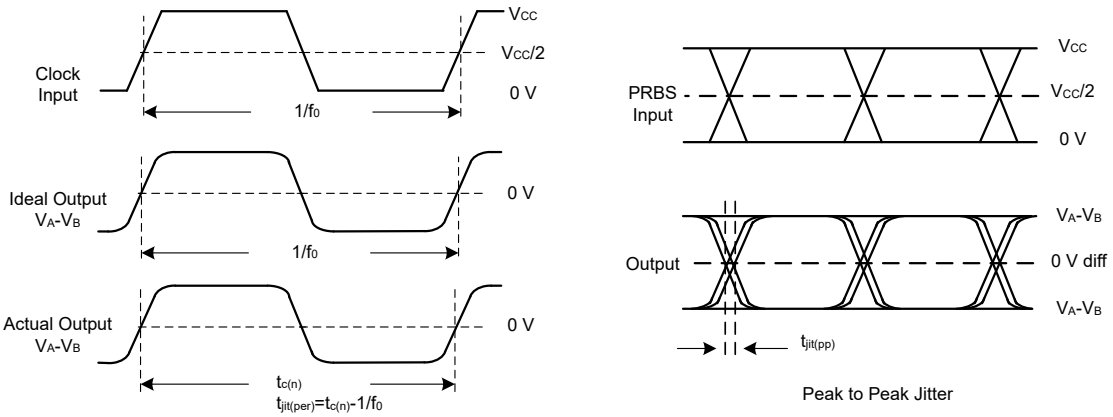


Figure 8. Driver Jitter Measurement Waveforms

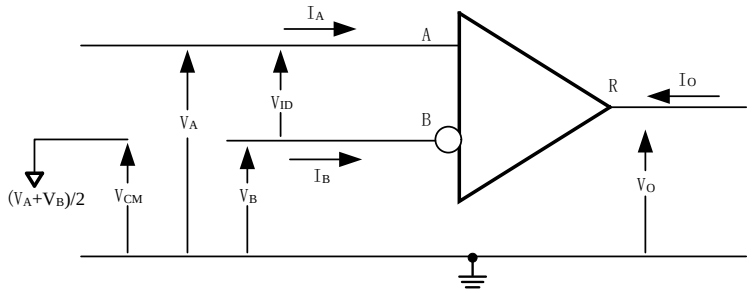


Figure 9. Receiver Voltage and Current Definitions

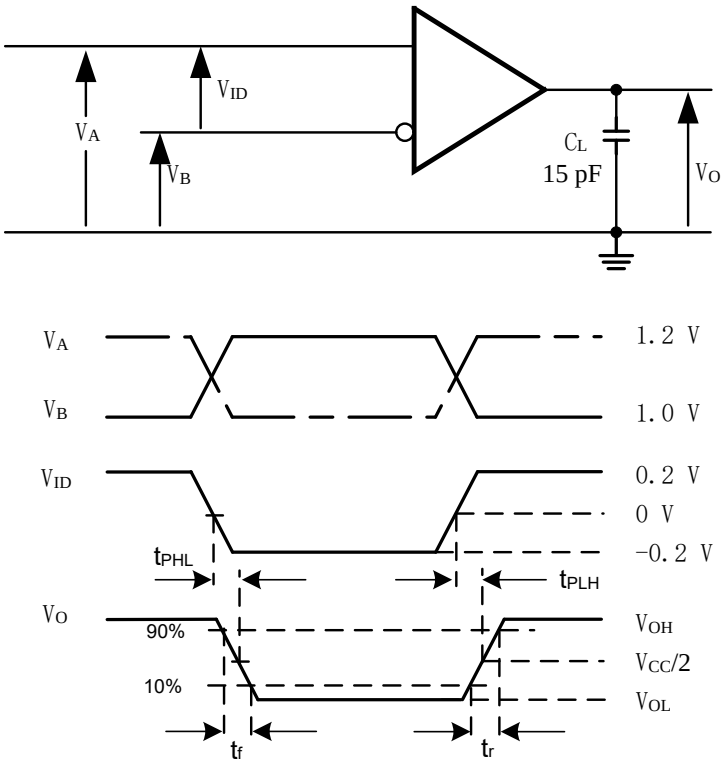


Figure 10. Receiver Timing Test Circuit and Waveforms

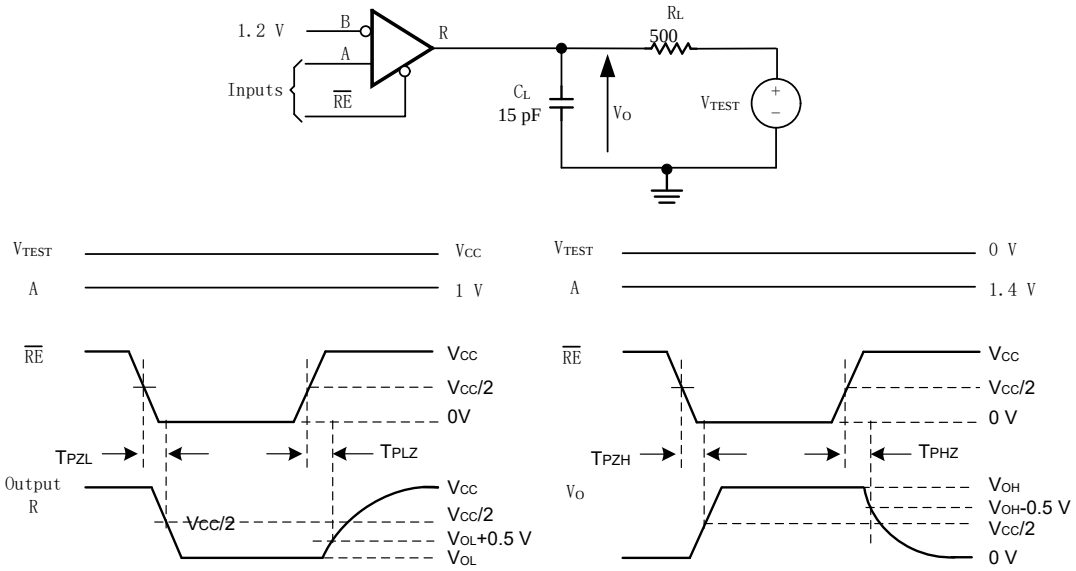


Figure 11. Receiver Enable/Disable Time Test Circuit and Waveforms

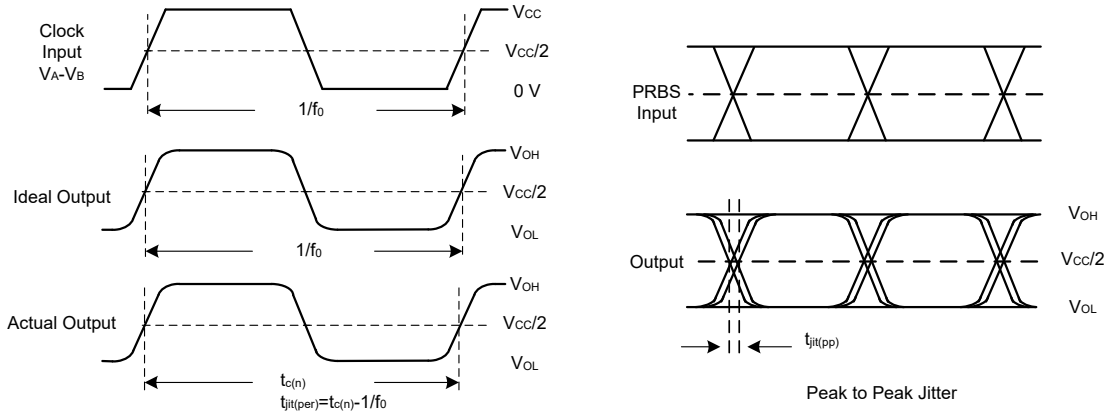


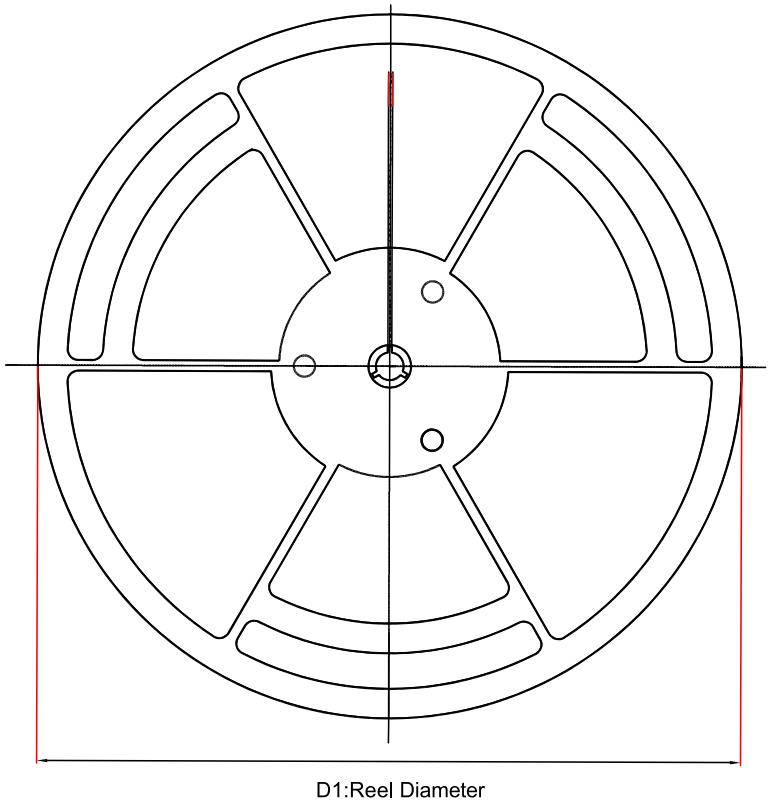
Figure 12. Receiver Jitter Measurement Waveforms

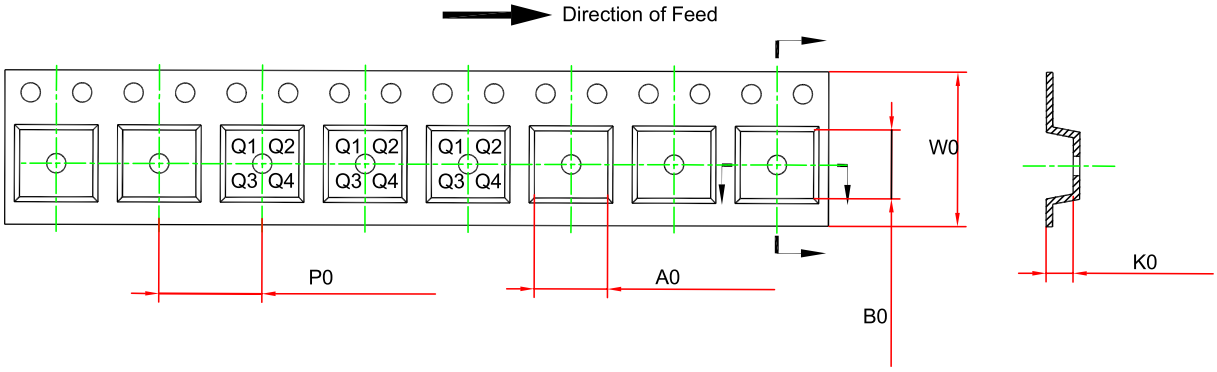
Application and Implementation

Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Tape and Reel Information





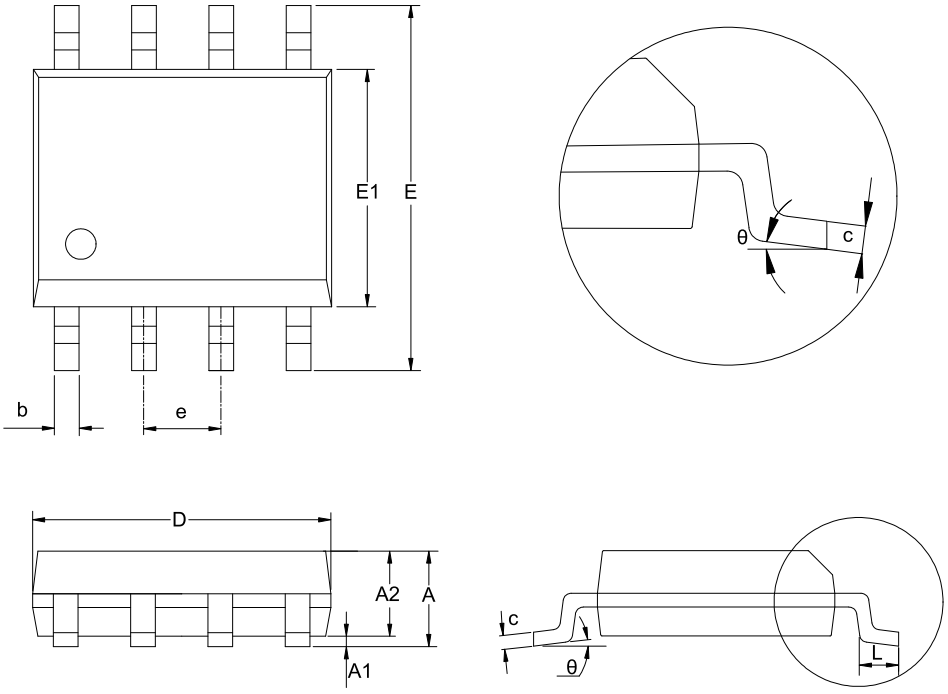
Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm) (1)	B0 (mm) (1)	K0 (mm) (1)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPT9H2211-SO1R	SOP8	330.0	17.5	6.5	5.4	2	8	12	Q1

(1) The value is for reference only. Contact the 3PEAK factory for more information.

Package Outline Dimensions

SOP8

Package Outline Dimensions SO1(SOP-8-B)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	1.550	0.049	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270 BSC		0.050 BSC	
L	0.400	1.000	0.016	0.039
θ	0	8°	0	8°

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPT9H2211-SO1R	−40 to 125°C	SOP-8	9H2211	MSL1	Tape and Reel, 4000	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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