

## DS25BR120 3.125 Gbps LVDS Buffer with Transmit Pre-Emphasis

Check for Samples: [DS25BR120](#)

### FEATURES

- DC - 3.125 Gbps Low Jitter, High Noise Immunity, Low Power Operation
- Four Levels of Transmit Pre-Emphasis Drive Lossy Backplanes and Cables
- On-Chip 100Ω Input and Output Termination Minimizes Insertion and Return Losses, Reduces Component Count, and Minimizes Board Space
- 7 kV ESD on LVDS I/O pins Protects Adjoining Components

- Small 3 mm x 3 mm 8-WSON Space Saving Package

### APPLICATIONS

- Clock and Data Buffering
- Metallic Cable Driving
- FR-4 Driving

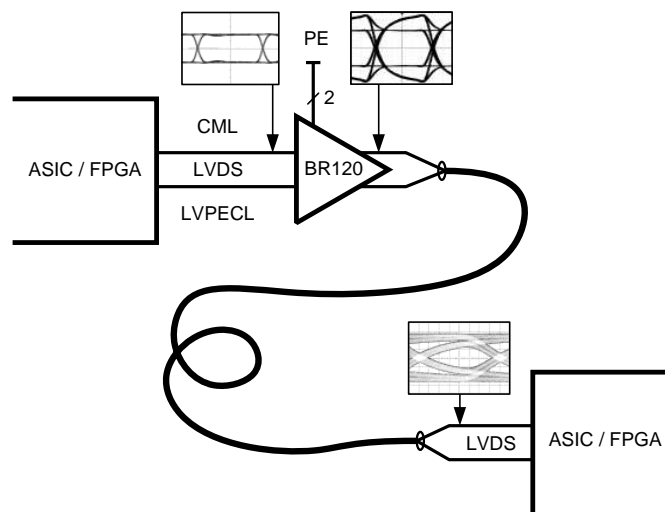
### DESCRIPTION

The DS25BR120 is a single channel 3.125 Gbps LVDS buffer optimized for high-speed signal transmission over lossy FR-4 printed circuit board backplanes and balanced metallic cables. Fully differential signal paths ensure exceptional signal integrity and noise immunity.

The DS25BR120 features four levels of pre-emphasis (PE) for use as an optimized driver device. Other LVDS devices with similar IO characteristics include the following products. The DS25BR110 features four levels of equalization for use as an optimized receiver device, while the DS25BR100 features both pre-emphasis and equalization for use as an optimized repeater device. The DS25BR150 is a buffer/repeater with the lowest power consumption and does not feature transmit pre-emphasis nor receive equalization.

Wide input common mode range allows the receiver to accept signals with LVDS, CML and LVPECL levels; the output levels are LVDS. A very small package footprint requires minimal space on the board while the flow-through pinout allows easy board layout. The differential inputs and outputs are internally terminated with a 100Ω resistor to lower device input and output return losses, reduce component count and further minimize board space.

### Typical Application



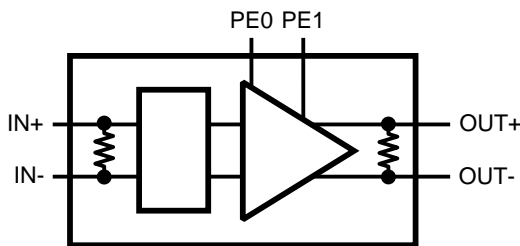
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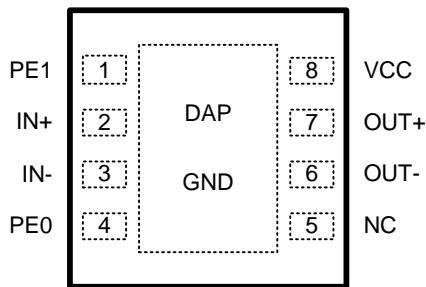
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**Block Diagram**



**Pin Diagram**



**WSON Package**

**PIN DESCRIPTIONS**

Pin Name	Pin Name	Pin Type	Pin Description
PE1	1	Input	Pre-emphasis select pin.
IN+	2	Input	Non-inverting LVDS input pin.
IN-	3	Input	Inverting LVDS input pin.
PE0	4	Input	Pre-emphasis select pin.
NC	5	NA	"NO CONNECT" pin.
OUT-	6	Output	Inverting LVDS output pin.
OUT+	7	Output	Non-inverting LVDS Output pin.
VCC	8	Power	Power supply pin.
GND	DAP	Power	Ground pad (DAP - die attach pad)

**Pre-Emphasis Truth Table**

PE1	PE0	Pre-emphasis Level
0	0	Off
0	1	Low (Approx. 3 dB at 1.56 GHz)
1	0	Medium (Approx. 6 dB at 1.56 GHz)
1	1	High (Approx. 9 dB at 1.56 GHz)



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## Absolute Maximum Ratings<sup>(1)(2)</sup>

Supply Voltage ( $V_{CC}$ )	–0.3V to +4V
LVCMOS Input Voltage (PE0, PE1)	–0.3V to ( $V_{CC} + 0.3V$ )
LVDS Input Voltage (IN+, IN–)	–0.3V to +4V
Differential Input Voltage  VID	1.0V
LVDS Output Voltage (OUT+, OUT–)	–0.3V to ( $V_{CC} + 0.3V$ )
LVDS Differential Output Voltage ((OUT+) – (OUT–))	0V to 1.0V
LVDS Output Short Circuit Current Duration	5 ms
Junction Temperature	+150°C
Storage Temperature Range	–65°C to +150°C
Lead Temperature Range	
Soldering (4 sec.)	+260°C
Maximum Package Power Dissipation at 25°C	
NGQ Package	2.08W
Derate NGQ Package	16.7 mW/°C above +25°C
Package Thermal Resistance	
$\theta_{JA}$	+60.0°C/W
$\theta_{JC}$	+12.3°C/W
ESD Susceptibility	
HBM <sup>(3)</sup>	≥7 kV
MM <sup>(4)</sup>	≥250V
CDM <sup>(5)</sup>	≥1250V

- (1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur, including inoperability and degradation of device reliability and/or performance. Functional operation of the device and/or non-degradation at the Absolute Maximum Ratings or other conditions beyond those indicated in the Recommended Operating Conditions is not implied. The Recommended Operating Conditions indicate conditions at which the device is functional and the device should not be operated beyond such conditions.
- (2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (3) Human Body Model, applicable std. JESD22-A114C
- (4) Machine Model, applicable std. JESD22-A115-A
- (5) Field Induced Charge Device Model, applicable std. JESD22-C101-C

## Recommended Operating Conditions

	Min	Typ	Max	Units
Supply Voltage ( $V_{CC}$ )	3.0	3.3	3.6	V
Receiver Differential Input Voltage ( $V_{ID}$ )	0		1.0	V
Operating Free Air Temperature ( $T_A$ )	–40	+25	+85	°C

## Electrical Characteristics

Over recommended operating supply and temperature ranges unless otherwise specified.<sup>(1)(2)(3)</sup>

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>LVCMOS INPUT DC SPECIFICATIONS (PE0, PE1)</b>						
$V_{IH}$	High Level Input Voltage		2.0		$V_{CC}$	V
$V_{IL}$	Low Level Input Voltage		GND		0.8	V
$I_{IH}$	High Level Input Current	$V_{IN} = 3.6V$ $V_{CC} = 3.6V$		0	±10	μA
$I_{IL}$	Low Level Input Current	$V_{IN} = GND$ $V_{CC} = 3.6V$		0	±10	μA

- (1) The Electrical Characteristics tables list guaranteed specifications under the listed Recommended Operating Conditions except as otherwise modified or specified by the Electrical Characteristics Conditions and/or Notes. Typical specifications are estimations only and are not guaranteed.
- (2) Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground except  $V_{OD}$  and  $\Delta V_{OD}$ .
- (3) Typical values represent most likely parametric norms for  $V_{CC} = +3.3V$  and  $T_A = +25^\circ C$ , and at the Recommended Operation Conditions at the time of product characterization and are not guaranteed.

## Electrical Characteristics (continued)

Over recommended operating supply and temperature ranges unless otherwise specified.<sup>(1)(2)(3)</sup>

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{CL}$	Input Clamp Voltage	$I_{CL} = -18 \text{ mA}$ , $V_{CC} = 0\text{V}$		-0.9	-1.5	V
<b>LVDS OUTPUT DC SPECIFICATIONS (OUT+, OUT-)</b>						
$V_{OD}$	Differential Output Voltage	$R_L = 100\Omega$	250	350	450	mV
$\Delta V_{OD}$	Change in Magnitude of $V_{OD}$ for Complimentary Output States		-35		35	mV
$V_{OS}$	Offset Voltage	$R_L = 100\Omega$	1.05	1.2	1.375	V
$\Delta V_{OS}$	Change in Magnitude of $V_{OS}$ for Complimentary Output States		-35		35	mV
$I_{OS}$	Output Short Circuit Current <sup>(4)</sup>	OUT to GND $PE0 = PE1 = 0$		-35	-55	mA
		OUT to $V_{CC}$ $PE0 = PE1 = 0$		7	55	mA
$C_{OUT}$	Output Capacitance	Any LVDS Output Pin to GND		1.2		pF
$R_{OUT}$	Output Termination Resistor	Between OUT+ and OUT-		100		$\Omega$
<b>LVDS INPUT DC SPECIFICATIONS (IN+, IN-)</b>						
$V_{ID}$	Input Differential Voltage		0		1	V
$V_{TH}$	Differential Input High Threshold	$V_{CM} = +0.05\text{V}$ or $V_{CC}-0.05\text{V}$		0	+100	mV
$V_{TL}$	Differential Input Low Threshold		-100	0		mV
$V_{CMR}$	Common Mode Voltage Range	$V_{ID} = 100 \text{ mV}$	0.05		$V_{CC} - 0.05$	V
$I_{IN}$	Input Current	$V_{IN} = 3.6\text{V}$ or $0\text{V}$ $V_{CC} = 3.6\text{V}$ or $0\text{V}$		$\pm 1$	$\pm 10$	$\mu\text{A}$
$C_{IN}$	Input Capacitance	Any LVDS Input Pin to GND		1.7		pF
$R_{IN}$	Input Termination Resistor	Between IN+ and IN-		100		$\Omega$
<b>SUPPLY CURRENT</b>						
$I_{CC}$	Supply Current	$PE0 = 0$ , $PE1 = 0$		35	43	mA

(4) Output short circuit current ( $I_{OS}$ ) is specified as magnitude only, minus sign indicates direction only.

## AC Electrical Characteristics <sup>(1)</sup>

Over recommended operating supply and temperature ranges unless otherwise specified. <sup>(2)</sup> <sup>(3)</sup>

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>LVDS OUTPUT AC SPECIFICATIONS (OUT+, OUT-)</b>						
$t_{PHLD}$	Differential Propagation Delay High to Low	$R_L = 100\Omega$		350	465	ps
$t_{PLHD}$	Differential Propagation Delay Low to High			350	465	ps
$t_{SKD1}$	Pulse Skew $ t_{PLHD} - t_{PHLD} $ <sup>(4)</sup>			45	100	ps
$t_{SKD2}$	Part to Part Skew <sup>(5)</sup>			45	150	ps
$t_{LHT}$	Rise Time	$R_L = 100\Omega$		80	150	ps
$t_{HLT}$	Fall Time			80	150	ps

(1) Specification is guaranteed by characterization and is not tested in production.

(2) The Electrical Characteristics tables list guaranteed specifications under the listed Recommended Operating Conditions except as otherwise modified or specified by the Electrical Characteristics Conditions and/or Notes. Typical specifications are estimations only and are not guaranteed.

(3) Typical values represent most likely parametric norms for  $V_{CC} = +3.3\text{V}$  and  $T_A = +25^\circ\text{C}$ , and at the Recommended Operation Conditions at the time of product characterization and are not guaranteed.

(4)  $t_{SKD1}$ ,  $|t_{PLHD} - t_{PHLD}|$ , is the magnitude difference in differential propagation delay time between the positive going edge and the negative going edge of the same channel.

(5)  $t_{SKD2}$ , Part to Part Skew, is defined as the difference between the minimum and maximum specified differential propagation delays. This specification applies to devices at the same  $V_{CC}$  and within  $5^\circ\text{C}$  of each other within the operating temperature range.

## AC Electrical Characteristics <sup>(1)</sup> (continued)

Over recommended operating supply and temperature ranges unless otherwise specified. <sup>(2)</sup> <sup>(3)</sup>

Symbol	Parameter	Conditions	Min	Typ	Max	Units
JITTER PERFORMANCE WITH PE = OFF						
t <sub>RJ1A</sub>	Random Jitter (RMS Value)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V Clock (RZ) PE0 = 0, PE1 = 0	2.5 Gbps		0.5	1 ps
t <sub>RJ2A</sub>	No Test Channels (6)		3.125 Gbps		0.5	1 ps
t <sub>DJ1A</sub>	Deterministic Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V K28.5 (NRZ) PE0 = 0, PE1 = 0	2.5 Gbps		9	31 ps
t <sub>DJ2A</sub>	No Test Channels (7)		3.125 Gbps		16	40 ps
t <sub>TJ1A</sub>	Total Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V PRBS-23 (NRZ) PE0 = 0, PE1 = 0	2.5 Gbps		0.05	0.13 U <sub>I<sub>P-P</sub></sub>
t <sub>TJ2A</sub>	No Test Channels (8)		3.125 Gbps		0.09	0.16 U <sub>I<sub>P-P</sub></sub>
JITTER PERFORMANCE WITH PE = LOW (Figure 5 and Figure 6)						
t <sub>RJ1B</sub>	Random Jitter (RMS Value)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V Clock (RZ) PE0 = 1, PE1 = 0	2.5 Gbps		0.5	1.3 ps
t <sub>RJ2B</sub>	Test Channel A (6)		3.125 Gbps		0.5	1.3 ps
t <sub>DJ1B</sub>	Deterministic Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V K28.5 (NRZ) PE0 = 1, PE1 = 0	2.5 Gbps		17	31 ps
t <sub>DJ2B</sub>	Test Channel A (7)		3.125 Gbps		18	40 ps
t <sub>TJ1B</sub>	Total Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V PRBS-23 (NRZ) PE0 = 1, PE1 = 0	2.5 Gbps		0.09	0.14 U <sub>I<sub>P-P</sub></sub>
t <sub>TJ2B</sub>	Test Channel A (8)		3.125 Gbps		0.12	0.19 U <sub>I<sub>P-P</sub></sub>
JITTER PERFORMANCE WITH PE = MEDIUM (Figure 5 and Figure 6)						
t <sub>RJ1C</sub>	Random Jitter (RMS Value)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V Clock (RZ) PE0 = 0, PE1 = 1	2.5 Gbps		0.5	1.2 ps
t <sub>RJ2C</sub>	Test Channel B (6)		3.125 Gbps		0.5	1.2 ps
t <sub>DJ1C</sub>	Deterministic Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V K28.5 (NRZ) PE0 = 0, PE1 = 1	2.5 Gbps		21	44 ps
t <sub>DJ2C</sub>	Test Channel B (7)		3.125 Gbps		27	48 ps
t <sub>TJ1C</sub>	Total Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V PRBS-23 (NRZ) PE0 = 0, PE1 = 1	2.5 Gbps		0.09	0.16 U <sub>I<sub>P-P</sub></sub>
t <sub>TJ2C</sub>	Test Channel B (8)		3.125 Gbps		0.13	0.23 U <sub>I<sub>P-P</sub></sub>
JITTER PERFORMANCE WITH PE = HIGH (Figure 5 and Figure 6)						
t <sub>RJ1D</sub>	Random Jitter (RMS Value)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V Clock (RZ) PE0 = 1, PE1 = 1	2.5 Gbps		0.5	1.2 ps
t <sub>RJ2D</sub>	Test Channel C (6)		3.125 Gbps		0.5	1.2 ps
t <sub>DJ1D</sub>	Deterministic Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V K28.5 (NRZ) PE0 = 1, PE1 = 1	2.5 Gbps		30	65 ps
t <sub>DJ2D</sub>	Test Channel C (7)		3.125 Gbps		30	58 ps
t <sub>TJ1D</sub>	Total Jitter (Peak to Peak)	V <sub>ID</sub> = 350 mV V <sub>CM</sub> = 1.2V PRBS-23 (NRZ) PE0 = 1, PE1 = 1	2.5 Gbps		0.09	0.20 U <sub>I<sub>P-P</sub></sub>
t <sub>TJ2D</sub>	Test Channel C (8)		3.125 Gbps		0.13	0.22 U <sub>I<sub>P-P</sub></sub>

(6) Measured on a clock edge with a histogram and an accumulation of 1500 histogram hits. Input stimulus jitter is subtracted geometrically.

(7) Tested with a combination of the 1100000101 (K28.5+ character) and 0011111010 (K28.5- character) patterns. Input stimulus jitter is subtracted algebraically.

(8) Measured on an eye diagram with a histogram and an accumulation of 3500 histogram hits. Input stimulus jitter is subtracted.

## DC TEST CIRCUITS

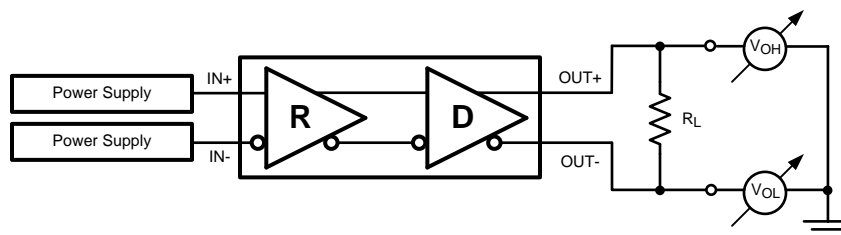


Figure 1. Differential Driver DC Test Circuit

## AC Test Circuits and Timing Diagrams

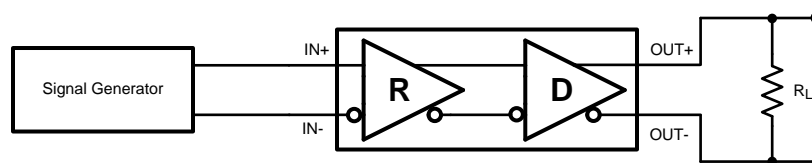


Figure 2. Differential Driver AC Test Circuit

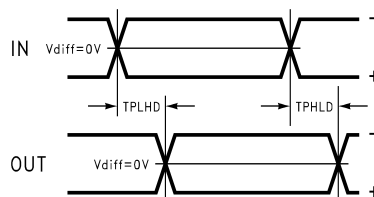


Figure 3. Propagation Delay Timing Diagram

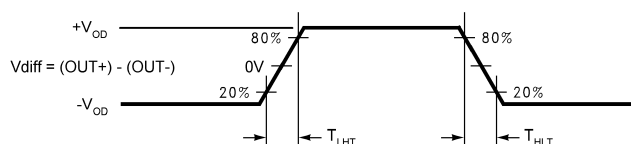


Figure 4. LVDS Output Transition Times

## Pre-Emphasis Test Circuits

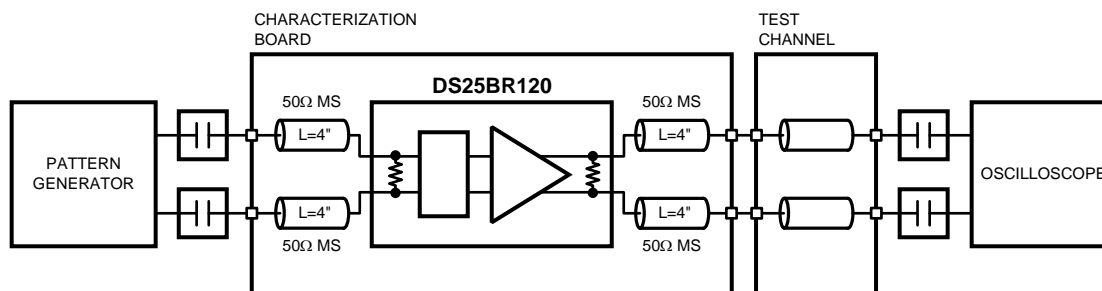
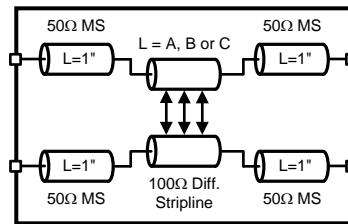


Figure 5. Pre-emphasis Performance Test Circuit



**Figure 6. Test Channel Description**

## Test Channel Loss Characteristics

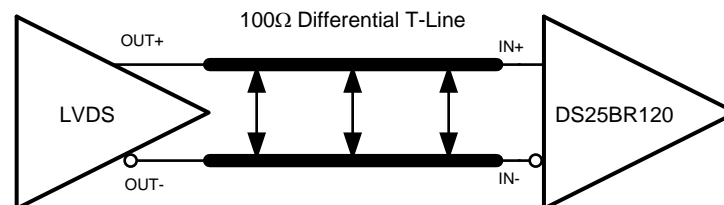
The test channel was fabricated with Polyclad PCL-FR-370-Laminate/PCL-FRP-370 Prepreg materials (Dielectric constant of 3.7 and Loss Tangent of 0.02). The edge coupled differential striplines have the following geometries: Trace Width (W) = 5 mils, Gap (S) = 5 mils, Height (B) = 16 mils.

Test Channel	Length (inches)	Insertion Loss (dB)					
		500 MHz	750 MHz	1000 MHz	1250 MHz	1500 MHz	1560 MHz
A	10	-1.2	-1.7	-2.0	-2.4	-2.7	-2.8
B	20	-2.6	-3.5	-4.1	-4.8	-5.5	-5.6
C	30	-4.3	-5.7	-7.0	-8.2	-9.4	-9.7
D	15	-1.6	-2.2	-2.7	-3.2	-3.7	-3.8
E	30	-3.4	-4.5	-5.6	-6.6	-7.7	-7.9
F	60	-7.8	-10.3	-12.4	-14.5	-16.6	-17.0

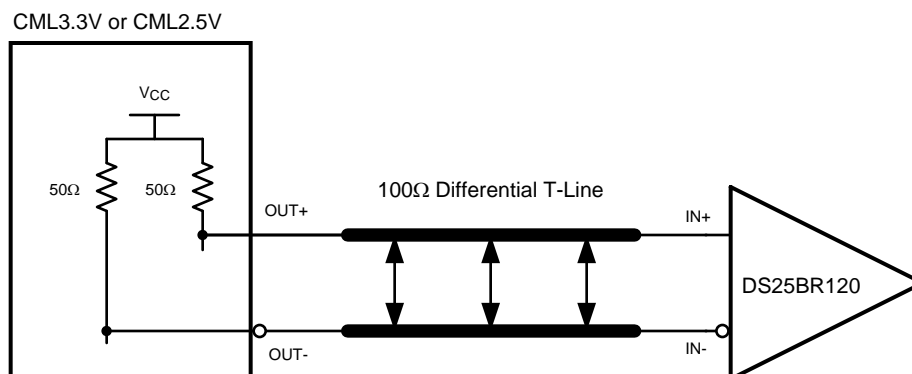
## Device Operation

### INPUT INTERFACING

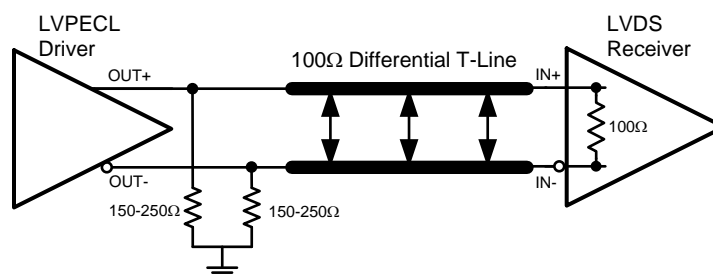
The DS25BR120 accepts differential signals and allows simple AC or DC coupling. With a wide common mode range, the DS25BR120 can be DC-coupled with all common differential drivers (i.e. LVPECL, LVDS, CML). The following three figures illustrate typical DC-coupled interface to common differential drivers. Note that the DS25BR120 inputs are internally terminated with a 100Ω resistor.



**Figure 7. Typical LVDS Driver DC-Coupled Interface to DS25BR120 Input**



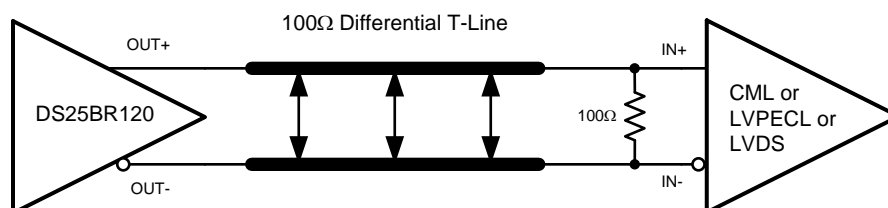
**Figure 8. Typical CML Driver DC-Coupled Interface to DS25BR120 Input**



**Figure 9. Typical LVPECL Driver DC-Coupled Interface to DS25BR120 Input**

## OUTPUT INTERFACING

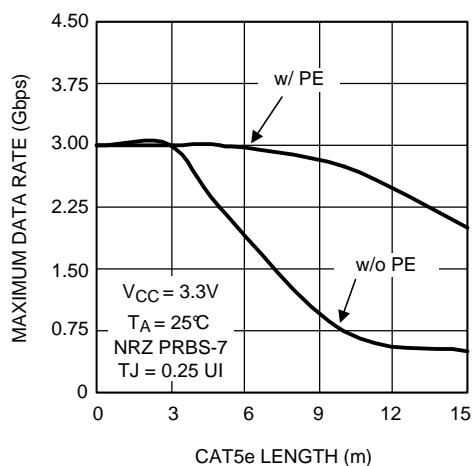
The DS25BR120 outputs signals compliant to the LVDS standard. It can be DC-coupled to most common differential receivers. The following figure illustrates typical DC-coupled interface to common differential receivers and assumes that the receivers have high impedance inputs. While most differential receivers have a common mode input range that can accommodate LVDS compliant signals, it is recommended to check the respective receiver's datasheet prior to implementing the suggested interface implementation.



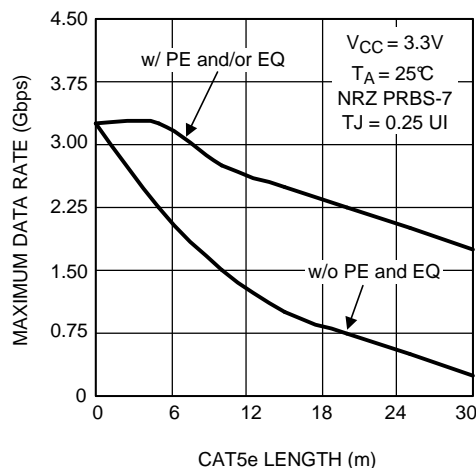
**Figure 10. Typical DS25BR120 Output DC-Coupled Interface to an LVDS, CML or LVPECL Receiver**



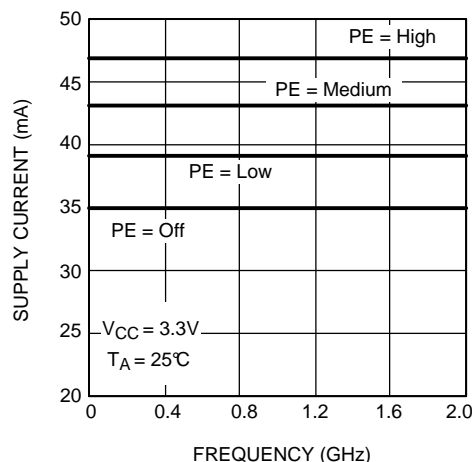
## TYPICAL PERFORMANCE CHARACTERISTICS



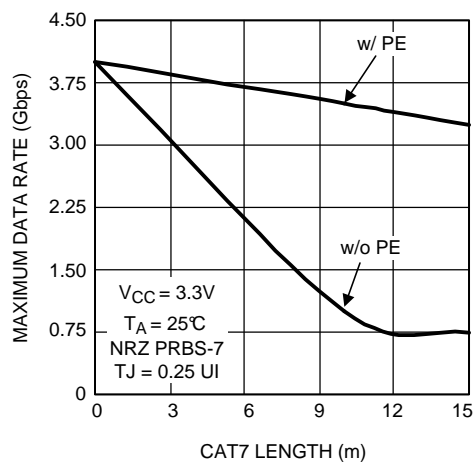
**Figure 11. Maximum Data Rate as a Function of CAT5e (Belden 1700A) Length**



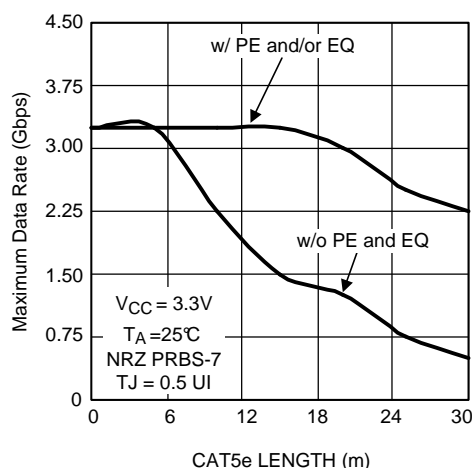
**Figure 12. Maximum Data Rate as a Function of CAT5e (Belden 1700A) Length  
DS25BR120 Used as a Driver  
DS25BR110 Used as a Receiver**



**Figure 13. Power Supply Current as a Function of Frequency**

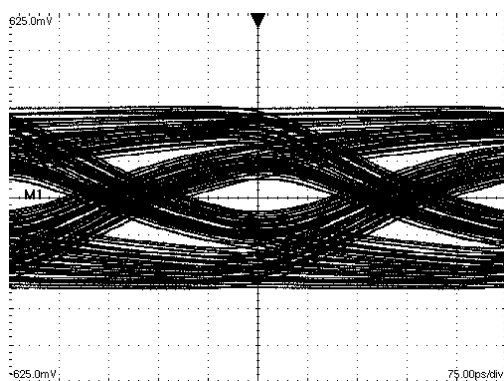


**Figure 14. Maximum Data Rate as a Function of CAT7 (Siemon Tera) Length**

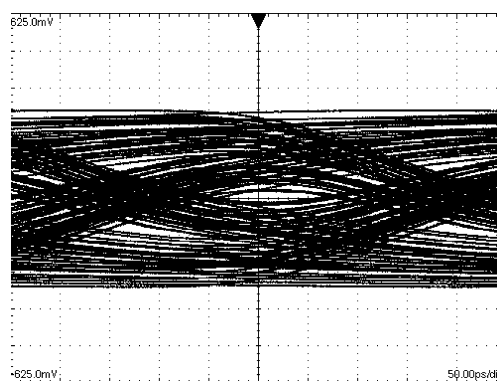


**Figure 15. Maximum Data Rate as a Function of CAT5e (Belden 1700A) Length  
DS25BR120 Used as a Driver  
DS25BR110 Used as a Receiver**

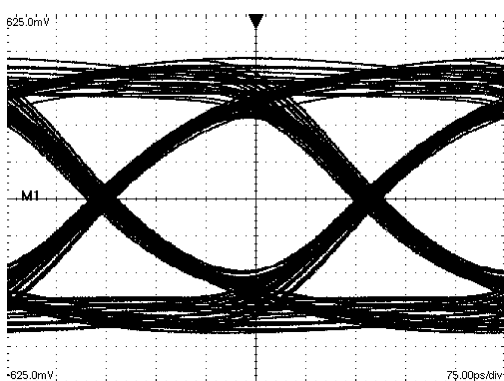
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



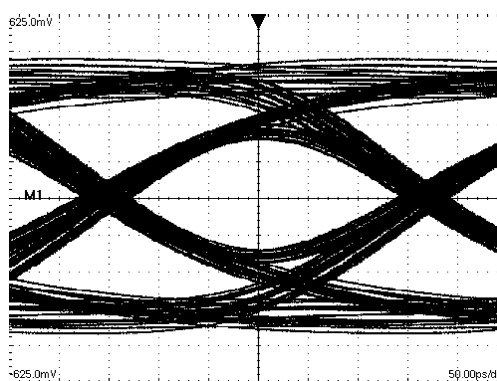
**Figure 16. A 2.5 Gbps NRZ PRBS-7 After 40"**  
Differential FR-4 Stripline  
V:125 mV / DIV, H:75 ps / DIV



**Figure 17. A 3.125 Gbps NRZ PRBS-7 After 40"**  
Differential FR-4 Stripline  
V:125 mV / DIV, H:50 ps / DIV



**Figure 18. An Equalized (with PE) 2.5 Gbps NRZ PRBS-7**  
After 40"  
Differential FR-4 Stripline  
V:125 mV / DIV, H:75 ps / DIV



**Figure 19. An Equalized (with PE) 3.125 Gbps NRZ PRBS-7**  
After 40"  
Differential FR-4 Stripline  
V:125 mV / DIV, H:50 ps / DIV

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
DS25BR120TSD/NOPB	ACTIVE	WSON	NGQ	8	1000	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	-40 to 85	2R120	<a href="#">Samples</a>
DS25BR120TSDX/NOPB	ACTIVE	WSON	NGQ	8	4500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	-40 to 85	2R120	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Only one of markings shown within the brackets will appear on the physical device.

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**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

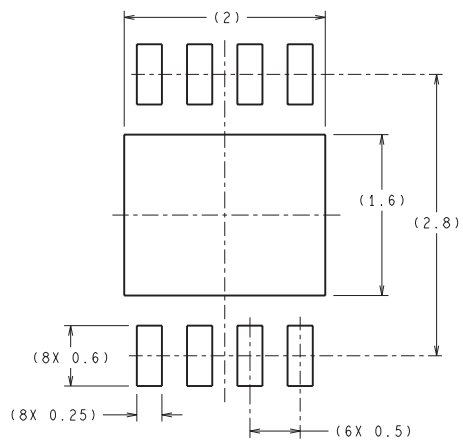
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS25BR120TSD/NOPB	WSO	NGQ	8	1000	178.0	12.4	3.3	3.3	1.0	8.0	12.0	Q1
DS25BR120TSDX/NOPB	WSO	NGQ	8	4500	330.0	12.4	3.3	3.3	1.0	8.0	12.0	Q1

## TAPE AND REEL BOX DIMENSIONS

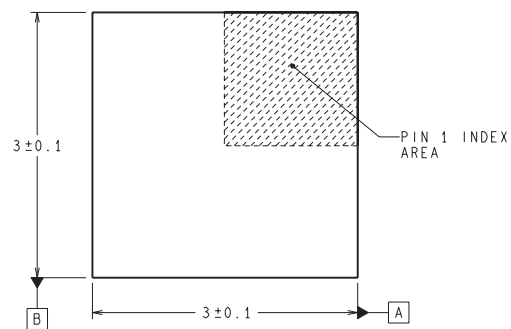


\*All dimensions are nominal

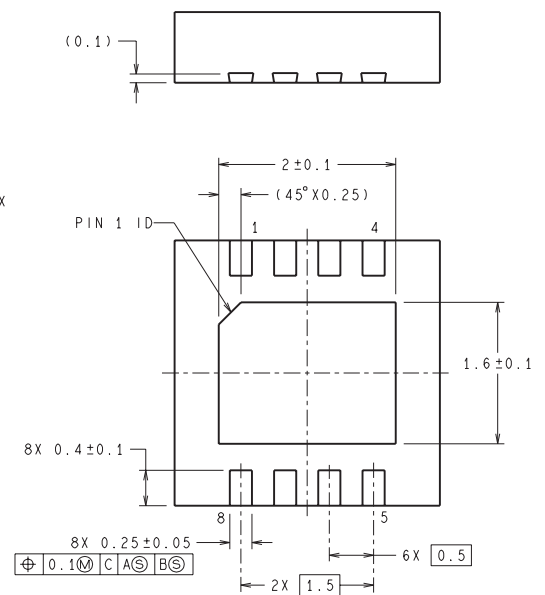
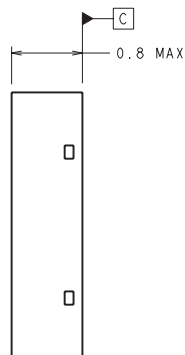
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS25BR120TSD/NOPB	WSO	NGQ	8	1000	213.0	191.0	55.0
DS25BR120TSDX/NOPB	WSO	NGQ	8	4500	367.0	367.0	35.0



### RECOMMENDED LAND PATTERN



**DIMENSIONS ARE IN MILLIMETERS**  
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SDA08A (Rev A)

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