HD3SS460 4 x 6 Channels USB Type-C Alternate Mode MUX

1 Features

- Provides MUX Solution for USB Type-C Ecosystem Including Alternate Mode (AM)
- Provides Wide Channel Selection Choices Including USBSS and 2 Ch AM, 4 Ch AM
- Compatible with USB3.1 Gen 1 and AM Including DisplayPort
- Provides Cross-point MUX for Low Speed Pins
- Excellent Dynamic Characteristics (at 2.5GHz)
  - Off Isolation = –23dB
  - Insertion Loss = –1.6dB
  - Return Loss = –11dB
- Bidirectional "Mux/De-Mux" Differential Switch
- Supports Common Mode Voltage 0-2V
- Single Supply Voltage VCC of 3.3V ±10%
- Industrial Temperature Range of –40 to 85°C
- Commercial Temperature Range of 0 to 70°C

2 Applications

- Flippable USB Type-C ecosystem
- Tablets, Laptops, Monitors, Phones
- USB Host and Devices
- Docking Stations

3 Description

The HD3SS460 is a high-speed bi-directional passive switch in mux or demux configurations. Based on control pin POL the device provides switching to accommodate connector flipping. The device also provides muxing between 2Ch Data / 2Ch Video and all 4Ch Video based on control pin AMSEL.

The device also provides a cross point MUX for the low speed pins as needed in the flippable connector implementation.

The HD3SS460 is a generic analog differential passive switch that can work for any high speed interface applications as long as it is biased at a common mode voltage range of 0-2V and has differential signaling with differential amplitude up to 1800mVpp. It employs an adaptive tracking that ensures the channel remains unchanged for entire common mode voltage range.

Excellent dynamic characteristics of the device allow high speed switching with minimum attenuation to the signal eye diagram with very little added jitter. It consumes <2 mW of power when operational and has a shutdown mode exercisable by EN pin resulting in <2µW.

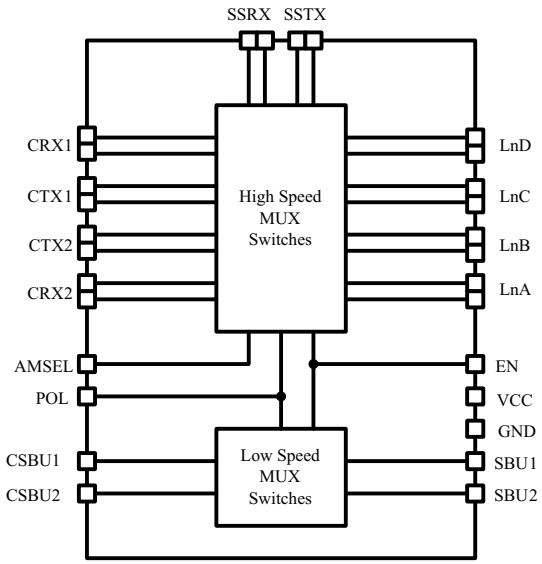
Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
HD3SS460	QFN (28)	3.50 mm × 5.50 mm

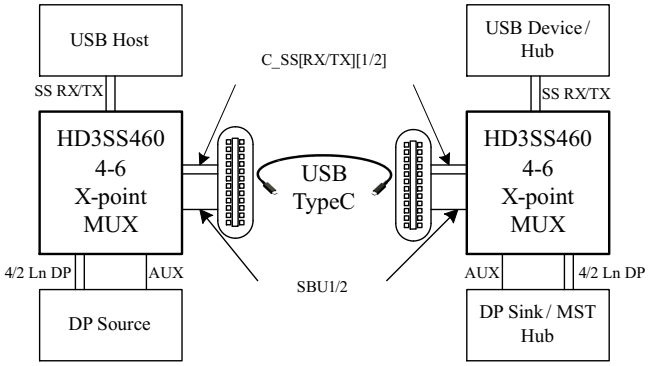
(1) For all available packages, see the orderable addendum at the end of the data sheet.

PRODUCT PREVIEW

Simplified Schematic



Application



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4 Revision History

DATE	REVISION	NOTES
January 2015	*	Initial release.

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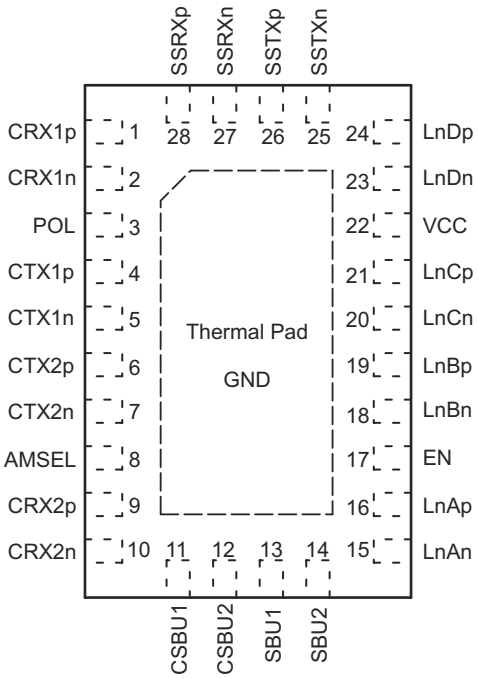
5 Pin Configuration and Functions

28-Pin WQFN Package With Thermal Pad
(RHR)
Top View



Pin Functions

PIN		TYPE(1)	DESCRIPTION
NAME	NO.		
VCC	22	P	Power
GND	PAD	G	Ground
POL	3	Input	Provides MUX control (Table 1 and 2)
AMSEL	8	3-Level Input	Provides MUX configurations (Table 1 and 2)
EN	17	3-Level Input	Enable signal; also provides MUX control (Table 1 and 2)
CRX1p, n	1, 2	I/O	High Speed Signal Port CRX1 positive, negative
CTX1p, n	4, 5	I/O	High Speed Signal Port CTX1 positive, negative
CTX2p, n	6, 7	I/O	High Speed Signal Port CTX2 positive, negative
CRX2p, n	9, 10	I/O	High Speed Signal Port CRX2 positive, negative
LnAn, p	15, 16	I/O	High Speed Signal Port LnA positive, negative
LnBn, p	18, 19	I/O	High Speed Signal Port LnB positive, negative
LnCn, p	20, 21	I/O	High Speed Signal Port LnC positive, negative
LnDn, p	23, 24	I/O	High Speed Signal Port LnD positive, negative
SSTXn, p	25, 26	I/O	High Speed Signal Port SSTX positive, negative
SSRXn, p	27, 28	I/O	High Speed Signal Port SSRX positive, negative
CSBU1, 2	11, 12	I/O	Low Speed Signal Port CSBU 1, 2
SBU1, 2	13, 14	I/O	Low Speed Signal Port SBU 1, 2

(1) High speed data ports (CRX[1/2][p/n], Ln[A-D][p,n], and SS[T/R]X[p/n]) incorporate 20kΩ pull down resistors that are switched in when a port is not selected and switched out when the port is selected.

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Timing Diagrams

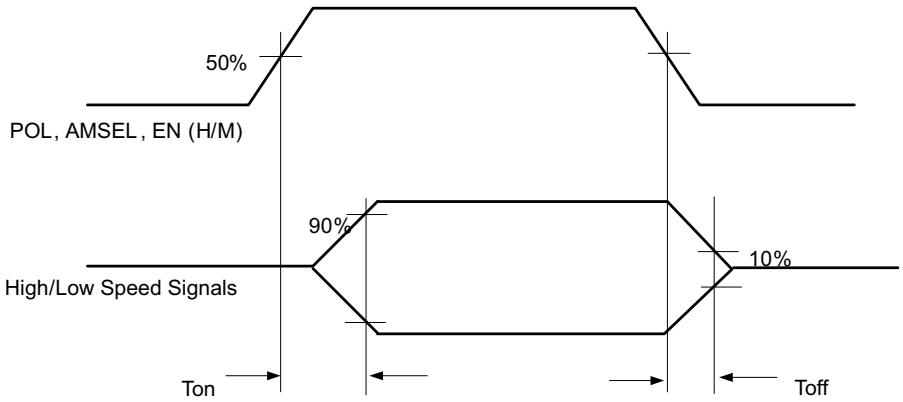
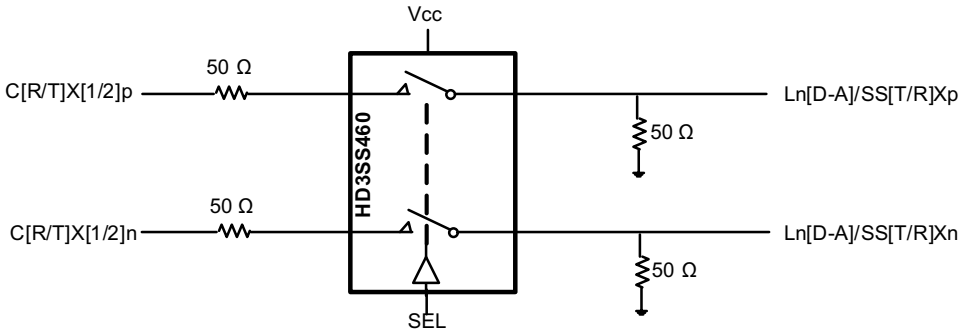
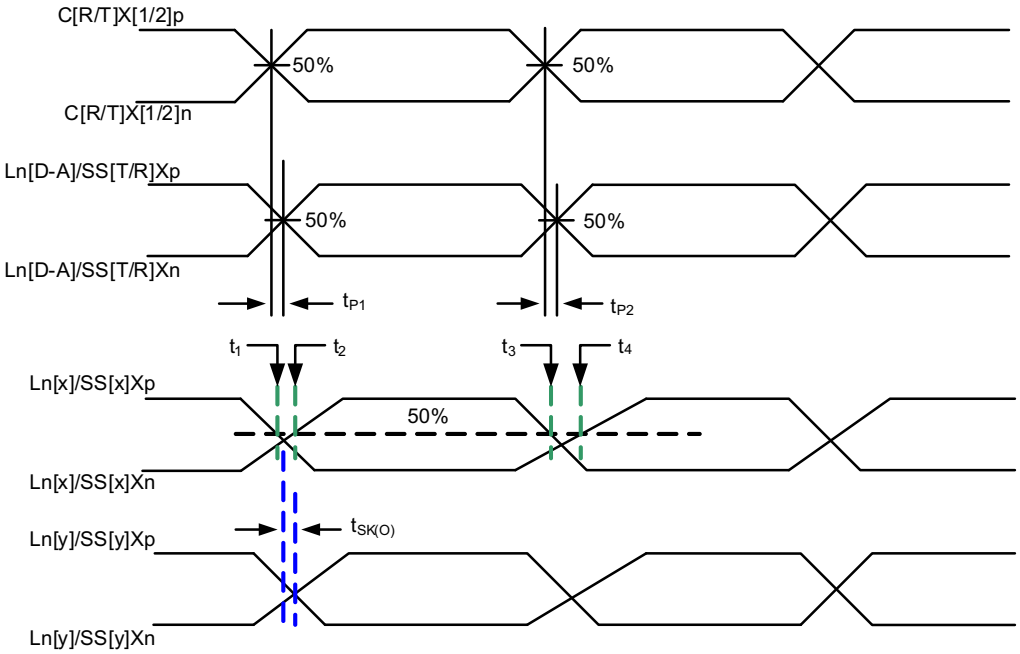


Figure 1. Switch ON/OFF Time





t_{PD} = Max(t_{p1}, t_{p2})

$t_{SK(O)}$ = Difference between t_{PD} for any two pairs of outputs

$t_{SK(b\text{-}b)}$ = 0.5 X |(t_4 – t_3) + (t_1 – t_2)|

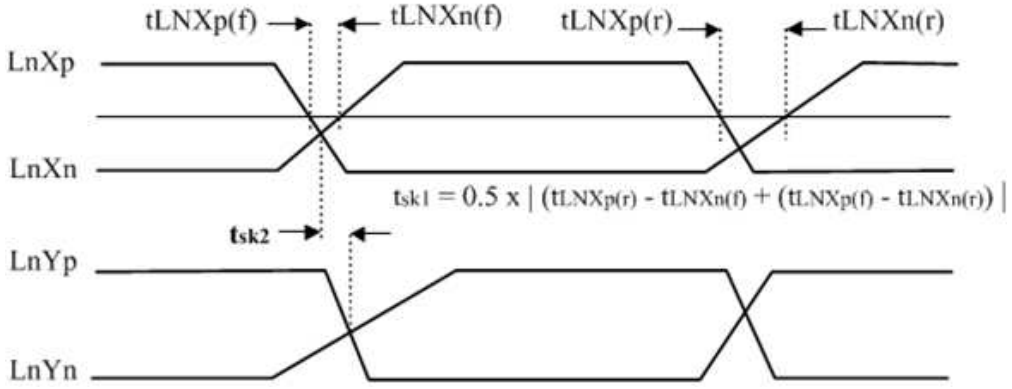


Figure 2. Propagation Delay and Skew

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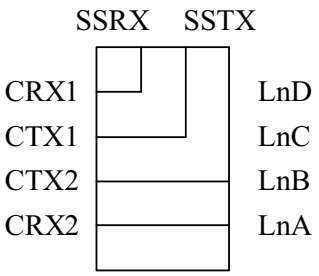
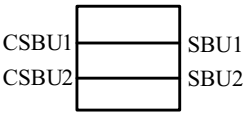
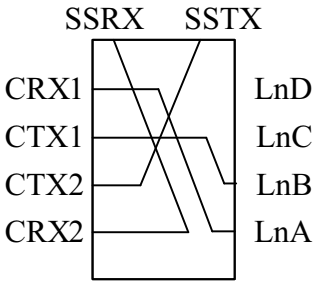
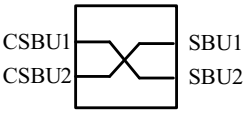
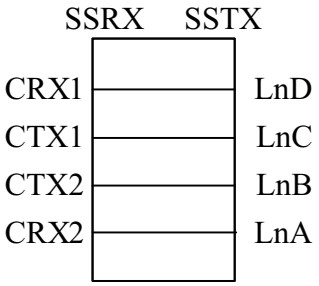
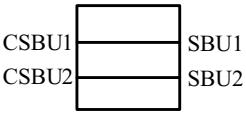
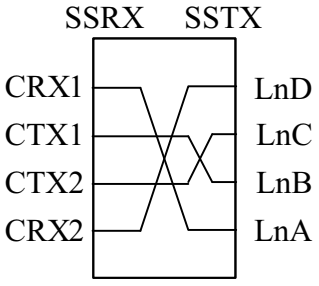
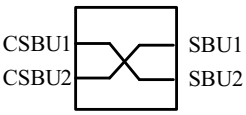
6 Detailed Description

6.1 Device Functional Modes

6.1.1 Device High Speed Switch Control Modes

Table 1. MUX Control for High Speed and Low Speed SBU Channels

POL	AMSEL	EN	CONFIGURATIONS	HIGH SPEED SIGNAL FLOW(1)	SBU SIGNAL FLOW
L	L	H	2CH USBSS + 2CH AM (Normal)		
H	L	H	2CH USBSS + 2CH AM (Flipped)		
L	H	H	4CH AM (Normal)		
H	H	H	4CH AM (Flipped)		

(1) All positive signals connect to positive and negative to negative

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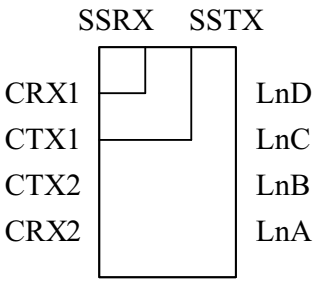
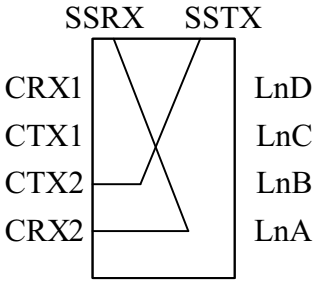
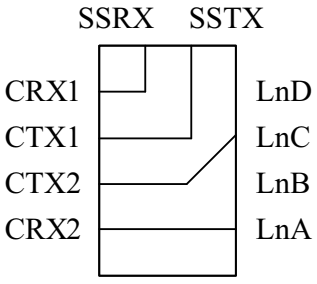
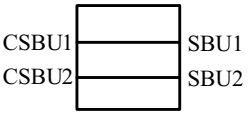
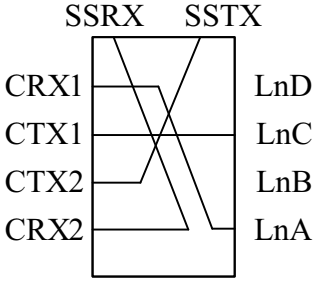
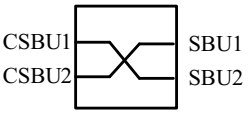
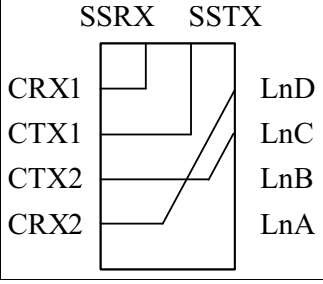
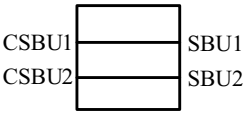
Device Functional Modes (continued)

Table 1. MUX Control for High Speed and Low Speed SBU Channels (continued)

POL	AMSEL	EN	CONFIGURATIONS	HIGH SPEED SIGNAL FLOW(1)	SBU SIGNAL FLOW
L	M	H	2CH USBSS (Normal)		All Low Speed SBU Ports HighZ
H	M	H	2CH USBSS (Flipped)		All Low Speed SBU Ports HighZ
L	M	M	2CH USBSS + 2CH AM (Normal)		
H	M	M	2CH USBSS + 2CH AM (Flipped)		
L	L	M	2CH USBSS + 2CH AM from alternate GPU (Normal)		

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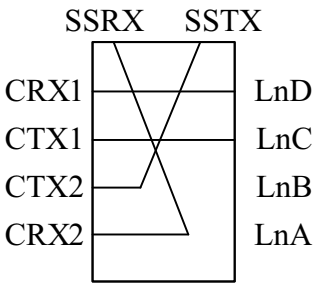
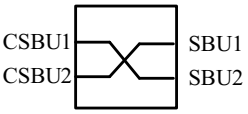
Device Functional Modes (continued)

Table 1. MUX Control for High Speed and Low Speed SBU Channels (continued)

POL	AMSEL	EN	CONFIGURATIONS	HIGH SPEED SIGNAL FLOW(1)	SBU SIGNAL FLOW
H	L	M	2CH USBSS + 2CH AM from alternate GPU (Flipped)		
L	H	M	Reserved	Reserved	Reserved
H	H	M	Reserved	Reserved	Reserved
X	X	L	All High Speed Ports HighZ	All High Speed Ports HighZ	All Low Speed SBU Ports HighZ

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7 Device and Documentation Support

7.1 Trademarks

All trademarks are the property of their respective owners.

7.2 Electrostatic Discharge Caution

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.

7.3 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

8 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
HD3SS460IRHRR	PREVIEW	WQFN	RHR	28	3000	TBD	Call TI	Call TI			
HD3SS460IRHRT	PREVIEW	WQFN	RHR	28	250	TBD	Call TI	Call TI			

(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) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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