

## DisplayPort 1:2 Switch

### FEATURES

- One Input Port to One of Two Output Ports
- Supports Data Rates up to 2.7Gbps
- Supports Dual-Mode DisplayPort
- Output Waveform Mimics Input Waveform Characteristics
- Enhanced ESD:
  - 12kV on all Main Link Pins
  - 10kV on all Auxiliary Pins
- Enhanced Commercial Temperature Range: 0°C to 85°C
- 56 Pin 8 × 8 QFN Package

### APPLICATIONS

- Personal Computer Market
  - Desktop PC
  - Notebook PC
  - Docking Station
  - Standalone Video Card

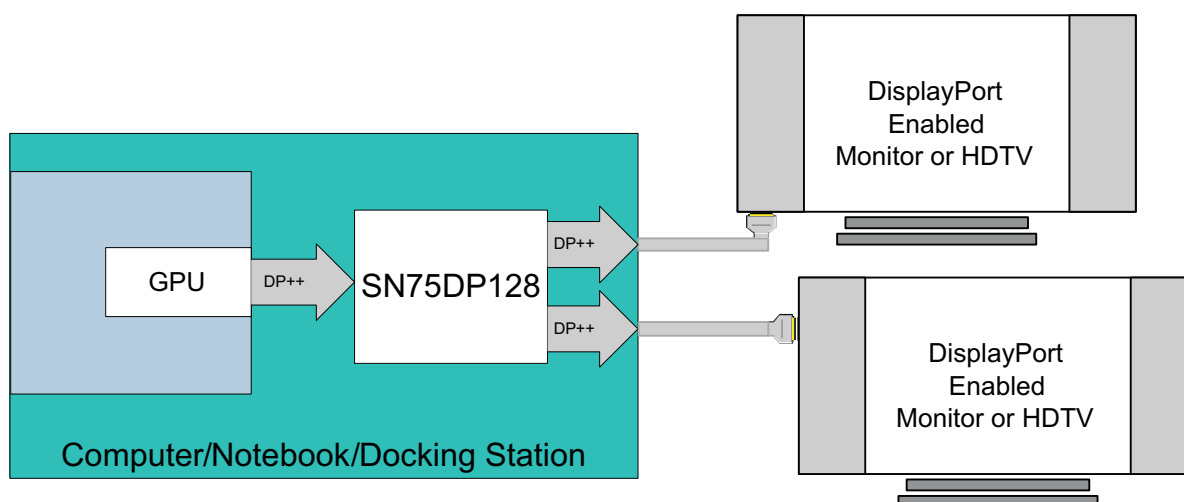
### DESCRIPTION

The SN75DP128 is a one Dual-Mode DisplayPort input to one of two Dual-Mode DisplayPort outputs. The outputs will follow the input signal in a manner that provides the highest level of signal integrity while supporting the EMI benefits of spread spectrum clocking. Through the SN75DP128 data rates of up to 2.7Gbps through each link for a total throughput of up to 10.8Gbps can be realized.

In addition to the switching of the DisplayPort high speed signal lines, the SN75DP128 also supports the switching of the bi-directional auxiliary (AUX), Hot Plug Detect (HPD), and Cable Adapter Detect (CAD) channels. The Auxiliary differential pair supports Dual-Mode DisplayPort operation with the ability to be configured as a bi-directional differential bus while in DisplayPort mode or an I<sup>2</sup>C™ bus while in TMDS mode

The SN75DP128 is characterized for operation over ambient air temperature of 0°C to 85°C.

### TYPICAL APPLICATION



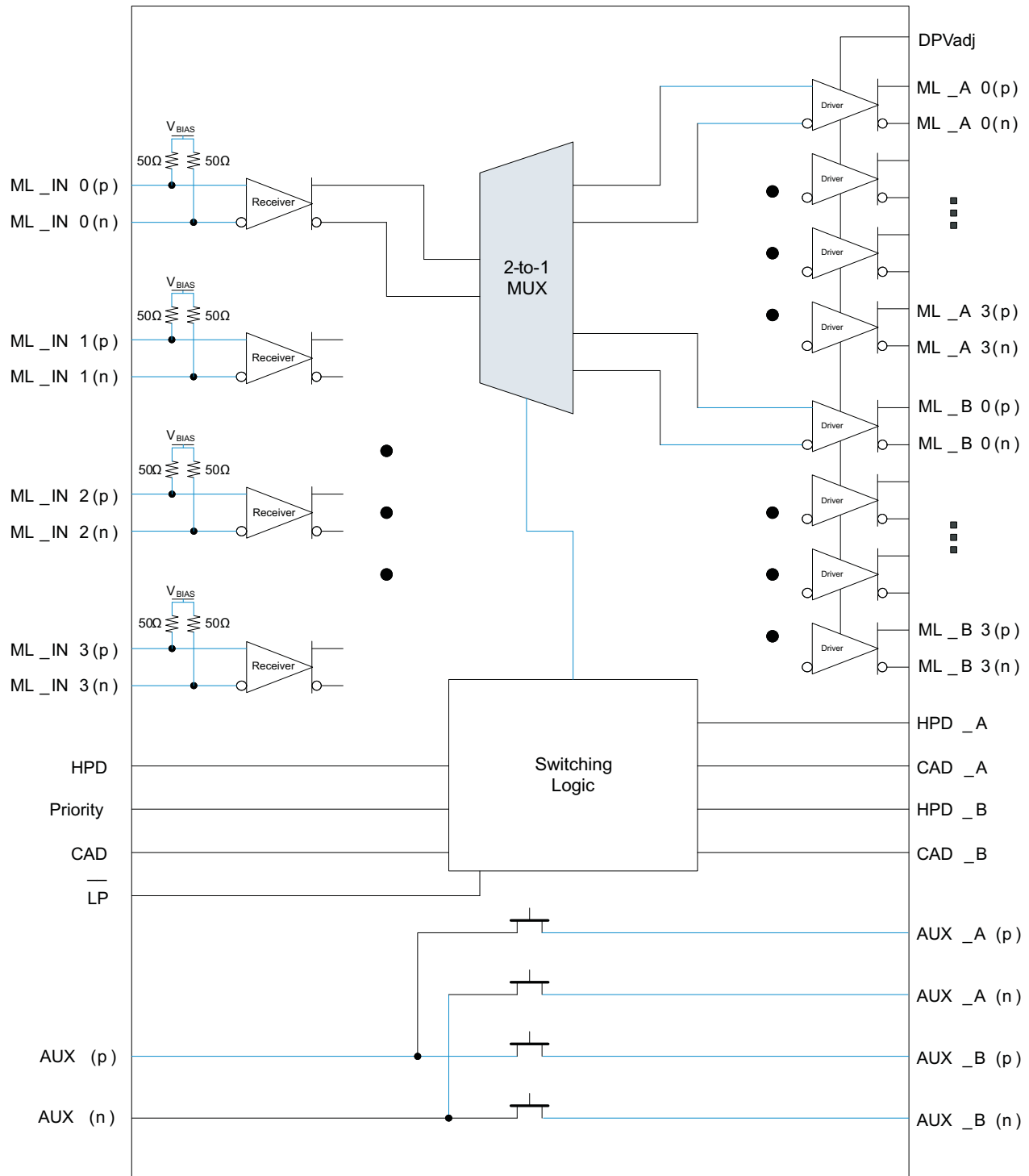
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

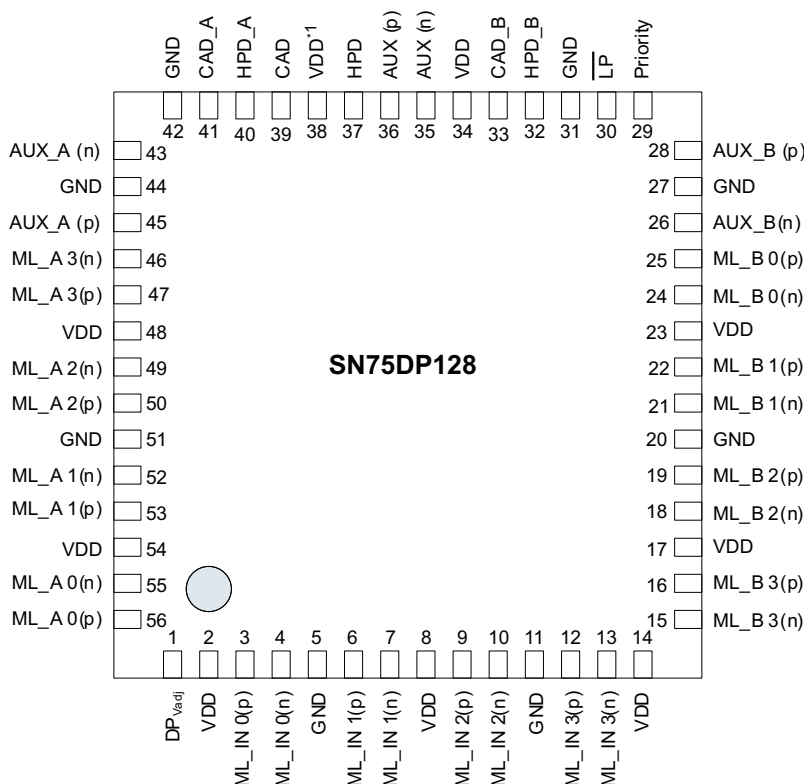
I<sup>2</sup>C is a trademark of Philips Electronics.



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.

## DATA FLOW BLOCK DIAGRAM





## TERMINAL FUNCTIONS

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
MAIN LINK INPUT PINS			
ML_IN 0	3, 4	I	DisplayPort Main Link Channel 0 Differential Input
ML_IN 1	6, 7	I	DisplayPort Main Link Channel 1 Differential Input
ML_IN 2	9, 10	I	DisplayPort Main Link Channel 2 Differential Input
ML_IN 3	12, 13	I	DisplayPort Main Link Channel 3 Differential Input
MAIN LINK PORT A OUTPUT PINS			
ML_A 0	56, 55	O	DisplayPort Main Link Port A Channel 0 Differential Output
ML_A 1	53, 52	O	DisplayPort Main Link Port A Channel 1 Differential Output
ML_A 2	50, 49	O	DisplayPort Main Link Port A Channel 2 Differential Output
ML_A 3	47, 46	O	DisplayPort Main Link Port A Channel 3 Differential Output
MAIN LINK PORT B OUTPUT PINS			
ML_B 0	25, 24	O	DisplayPort Main Link Port B Channel 0 Differential Output
ML_B 1	22, 21	O	DisplayPort Main Link Port B Channel 1 Differential Output
ML_B 2	19, 18	O	DisplayPort Main Link Port B Channel 2 Differential Output
ML_B 3	16, 15	O	DisplayPort Main Link Port B Channel 3 Differential Output
HOT PLUG DETECT PINS			
HPD	37	O	Hot Plug Detect Output to the DisplayPort Source
HDP_A	40	I	Port A Hot Plug Detect Input
HPD_B	32	I	Port B hot Plug Detect Input
AUXILIARY DATA PINS			
AUX	36, 35	I/O	Source Side Bidirectional DisplayPort Auxiliary Data Line
AUX_A	45, 43	I/O	Port A Bidirectional DisplayPort Auxiliary Data Line

**TERMINAL FUNCTIONS (continued)**

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
AUX_B	28, 26	I/O	Port B Bidirectional DisplayPort Auxiliary Data Line
<b>CABLE ADAPTER DETECT PINS</b>			
CAD	39	O	Cable Adapter Detect Output to the DisplayPort Source
CAD_A	41	I	Port A Cable Adapter Detect Input
CAD_B	33	I	Port B Cable Adapter Detect Input
<b>CONTROL PINS</b>			
$\overline{\text{LP}}$	30	I	Low Power Select Bar
Priority	29	I	Output Port Priority selection
DPVadj	1	I	DisplayPort Main Link Output Gain Adjustment
<b>SUPPLY and GROUND PINS</b>			
VDD	2, 8, 14, 17, 23, 34, 48, 54		Primary Supply Voltage
VDD* <sup>1</sup>	38		HPD and CAD Output Voltage
GND	5, 11, 20, 27, 42, 44, 51		Ground

**Table 1. Control Pin Lookup Table**

SIGNAL	LEVEL <sup>(1)</sup>	STATE	DESCRIPTION
$\overline{\text{LP}}$	H	Normal Mode	Normal operational mode for device
	L	Low Power Mode	Device is forced into a Low Power state causing the outputs to go to a high impedance state. All other inputs are ignored
Priority	H	Port B has Priority	If both HPD_A and HPD_B are high, Port B will be selected
	L	Port A has Priority	If both HPD_A and HPD_B are high, Port A will be selected
DP <sub>Vadj</sub>	4.53 k $\Omega$	Increased Gain	Main Link DisplayPort Output will have an increased voltage swing
	6.49 k $\Omega$	Normal Gain	Main Link DisplayPort Output will have a nominal voltage swing
	10 k $\Omega$	Decreased Gain	Main Link DisplayPort Output will have a decreased voltage swing

(1) (H) Logic High; (L) Logic Low

Explanation of the internal switching logic of the SN75DP128 is located in the Application Information section at the end of the data sheet.

**ORDERING INFORMATION<sup>(1)</sup>**

PART NUMBER	PART MARKING	PACKAGE
SN75DP128RTQR	DP128	56-pin QFN Reel (large)
SN75DP128RTQT	DP128	56-pin QFN Reel (small)

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		VALUE	UNIT
Supply Voltage Range <sup>(2)</sup>	$V_{DD}, V_{DD}^{*1}$	–0.3 to 5.25	V
Voltage Range	Main Link I/O (ML_IN x, ML_A x, ML_B x) Differential Voltage	1.5	V
	HPD and CAD I/O	–0.3 to $V_{DD} + 0.3$	V
	Auxiliary I/O	–0.3 to $V_{DD} + 0.3$	V
	Control I/O	–0.3 to $V_{DD} + 0.3$	V
Electrostatic discharge	Human body model <sup>(3)</sup>	Auxiliary I/O (AUX +/-, AUX_A +/-, & AUX_B +/-)	±10000
		All Other Pins	±12000
	Charged-device model <sup>(3)</sup>		±1000
	Machine model <sup>(4)</sup>		±200
Continuous power dissipation		See Dissipation Rating Table	

(1) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values, except differential voltages, are with respect to network ground terminal.

(3) Tested in accordance with JEDEC Standard 22, Test Method A114-B

(4) Tested in accordance with JEDEC Standard 22, Test Method A115-A

## DISSIPATION RATINGS

PACKAGE	PCB JEDEC STANDARD	$T_A \leq 25^\circ\text{C}$	DERATING FACTOR <sup>(1)</sup> ABOVE $T_A = 25^\circ\text{C}$	$T_A = 85^\circ\text{C}$ POWER RATING
56-pin QFN (RTQ)	Low-K	3623 mW	36.23 mW/°C	1449 mW
	High-K	1109 mW	11.03 mW/°C	443.9 mW

(1) This is the inverse of the junction-to-ambient thermal resistance when board-mounted and with no air flow.

## THERMAL CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX <sup>(1)</sup>	UNIT
$R_{\theta JB}$ Junction-to-board thermal resistance	4x4 Thermal vias under powerpad		11.03		°C/W
$R_{\theta JC}$ Junction-to-case thermal resistance			20.4		C/W
$P_D$ Device power dissipation DisplayPort selected	$\overline{CP} = 5V$ , ML: $V_{ID} = 600$ mV, 2.7 Gbps PRBS; AUX: $V_{ID} = 500$ mV, 1Mbps PRBS; HPD/CAD A and B = 5V; $V_{DD}^{*1} = V_{DD}$		300	340	mW
$P_{SD}$ Device power dissipation under low power	$\overline{CP} = 0V$ , HPD/CAD A and B = 5V; $V_{DD}^{*1} = V_{DD}$			85	μW

(1) The maximum rating is simulated under 5.25 V  $V_{DD}$ .

## RECOMMENDED OPERATING CONDITIONS

	MIN	NOM	MAX	UNIT
$V_{DD}$ Supply Voltage	4.5	5	5.25	V
$V_{DD}^{*1}$ HPD and CAD Output reference voltage	1.62		5.25	V
$T_A$ Operating free-air temperature	0		85	°C
<b>MAIN LINK DIFFERENTIAL PINS</b>				
$V_{ID}$ Peak-to-peak input differential voltage	0.15		1.4	V
$d_R$ Data rate			2.7	Gbps
$R_t$ Termination resistance	45	50	55	Ω
$V_{Oterm}$ Output termination voltage	0		2	V
<b>AUXILIARY PINS</b>				

**RECOMMENDED OPERATING CONDITIONS (continued)**

		MIN	NOM	MAX	UNIT
$V_I$	Input voltage	0		3.6	V
$d_R$	Data rate			1	MHz
<b>HPD, CAD, AND CONTROL PINS</b>					
$V_{IH}$	High-level input voltage	2		5.25	V
$V_{IL}$	Low-level input voltage	0		0.8	V

**DEVICE POWER**

The SN75DP128 is designed to operate off a single 5V supply.

**ELECTRICAL CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{DD}$	Supply current LP = 5V, $V_{DD}^{*1} = V_{DD}$ ML: $V_{ID} = 600$ mV, 2.7 Gbps PRBS AUX: $V_{ID} = 500$ mV, 1 Mbps PRBS HPD/CAD A and B = 5 V		60	65	mA
$I_{DD}^{*1}$	Supply current $V_{DD}^{*1} = 5.25$ V		0.1	4	mA
$I_{SD}$	Shutdown current $\overline{LP} = 0$ V		1	16	$\mu$ A

**HOT PLUG AND CABLE ADAPTER DETECT**

The SN75DP128 is designed to support the switching of the Hot Plug Detect and Cable adapter Detect signals. The SN75DP128 has a built in level shifter for the HPD and CAD outputs. The output voltage level of the HPD and CAD pins is defined by the voltage level of the  $V_{DD}^{*1}$  pin. Explanation of HPD and the internal logic of the SN75DP128 is located in the application section at the end of the data sheet.

**ELECTRICAL CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{OH5}$	High-level output voltage $I_{OH} = -100$ $\mu$ A, $V_{DD}^{*1} = 5$ V	4.5		5	V
$V_{OH3.3}$	High-level output voltage $I_{OH} = -100$ $\mu$ A, $V_{DD}^{*1} = 3.3$ V	3		3.3	V
$V_{OH2.5}$	High-level output voltage $I_{OH} = -100$ $\mu$ A, $V_{DD}^{*1} = 2.5$ V	2.25		2.5	V
$V_{OH1.8}$	High-level output voltage $I_{OH} = -100$ $\mu$ A, $V_{DD}^{*1} = 1.8$ V	1.62		1.8	V
$V_{OL}$	Low-level output voltage $I_{OH} = 100$ $\mu$ A	0		0.4	V
$I_H$	High-level input current $V_{IH} = 2.0$ V, $V_{DD} = 5.25$ V	-10		10	$\mu$ A
$I_L$	Low-level input current $V_{IL} = 0.8$ V, $V_{DD} = 5.25$ V	-10		10	$\mu$ A

**SWITCHING CHARACTERISTICS**

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PD(CAD)}$	Propagation delay $V_{DD}^{*1} = 5$ V	5		30	ns
$t_{PD(HPD)}$	Propagation delay $V_{DD}^{*1} = 5$ V	30		110	ns
$t_{T1(HPD)}$	HPD logic switch pause time $V_{DD}^{*1} = 5$ V	2		4.7	ms
$t_{T2(HPD)}$	HPD logic switch time $V_{DD}^{*1} = 5$ V	170		400	ms
$t_{M(HPD)}$	Minimum output pulse duration $V_{DD}^{*1} = 5$ V	100			ns
$t_{Z(HPD)}$	Low Power to High-level propagation delay $V_{DD}^{*1} = 5$ V	30	50	110	ns

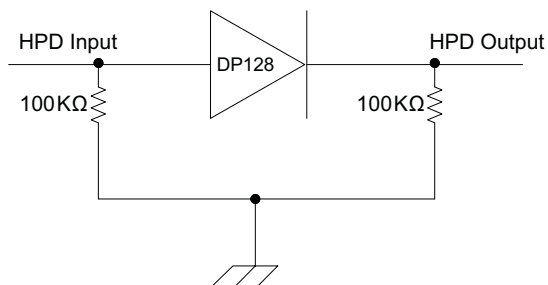


Figure 1. HPD Test Circuit

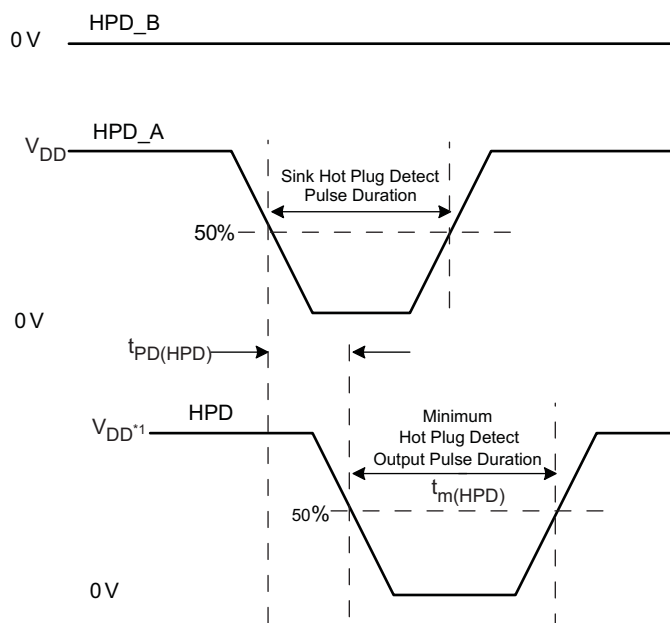


Figure 2. HPD Timing Diagram #1

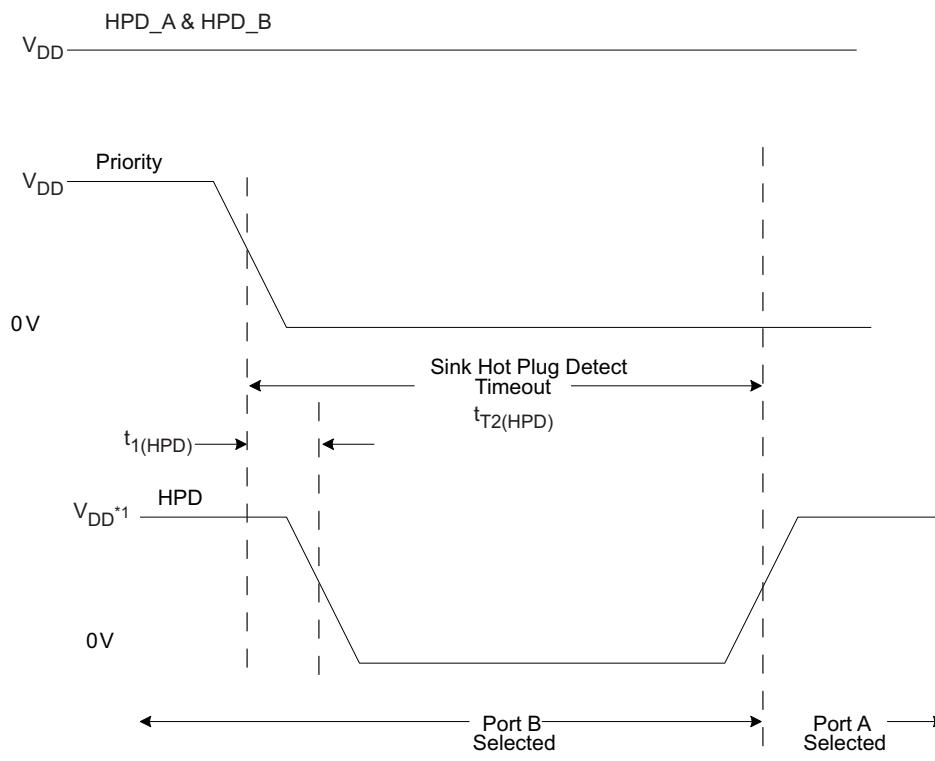


Figure 3. HPD Timing Diagram #2

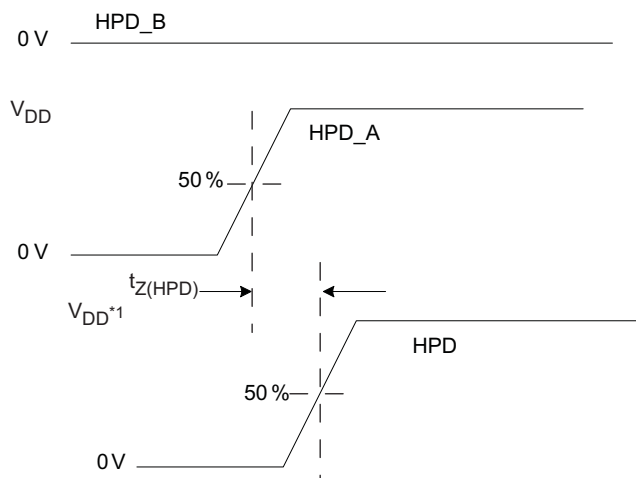


Figure 4. HPD Timing Diagram #3

## Auxiliary Pins

The SN75DP128 is designed to support the 1:2 switching of the bidirectional auxiliary signals in both a differential (DisplayPort) mode and an I<sup>2</sup>C (DVI, HDMI) mode. The performance of the Auxiliary bus is optimized based on the status of the selected output port's CAD pin.



## ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{Pass1}$ Maximum passthrough voltage (CAD=1)	$V_{DD} = 4.5\text{ V}$ , $V_I = 5\text{ V}$ , $I_O = 100\text{ }\mu\text{A}$	2.4		3.6	V
$I_{OZ}$ Output current from unselected output	$V_{DD} = 5.25\text{ V}$ , $V_O = 0\text{--}3.6\text{ V}$ , $V_I = 0\text{ V}$	–5		5	$\mu\text{A}$
$C_{IO(off)}$ I/O capacitance when in low power	DC bias = 1 V, AC = 1.4 Vp-p, F = 100 kHz,		9	12	pF
$C_{IO(on)}$ I/O capacitance when in normal operation	DC bias = 1 V, AC = 1.4 Vp-p, F = 100 kHz, CAD = High		18	25	pF
$r_{ON(C0)}$ On resistance	$V_{DD} = 4.5\text{ V}$ , $V_I = 0\text{--}3.6\text{ V}$ , $I_O = 5\text{ mA}$ , CAD = Low		3.5	10	$\Omega$
$\Delta r_{ON}$ On resistance	$V_{DD} = 4.5\text{ V}$ , $V_I = 0\text{--}3.6\text{ V}$ , $I_O = 5\text{ mA}$ , CAD = Low		1	5	$\Omega$
$r_{ON(C1)}$ On resistance	$V_{DD} = 4.5\text{ V}$ , $V_I = 0.4\text{ V}$ , $I_O = 3\text{ mA}$ , CAD = High		10	18	$\Omega$

## SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{sk(AUX)}$ Intra-pair skew	$V_{ID} = 400\text{ mV}$ , $V_{IC} = 2\text{ V}$		40	80	ps
$I_{L(AUX)}$ Single Line Insertion Loss	$V_{ID} = 500\text{ mV}$ , $V_{IC} = 2\text{ V}$ , F = 1 MHz, CAD = Low			0.4	dB
$t_{PLH(AUXC0)}$ Propagation delay time, low to high	CAD = Low, F = 1 MHz			3	ps
$t_{PHL(AUXC0)}$ Propagation delay time, high to low	CAD = Low, F = 1 MHz			3	ps
$t_{PLH(AUXC1)}$ Propagation delay time, low to high	CAD = High, F = 100 kHz			3	ns
$t_{PHL(AUXC1)}$ Propagation delay time, high to low	CAD = High, F = 100 kHz			3	ns

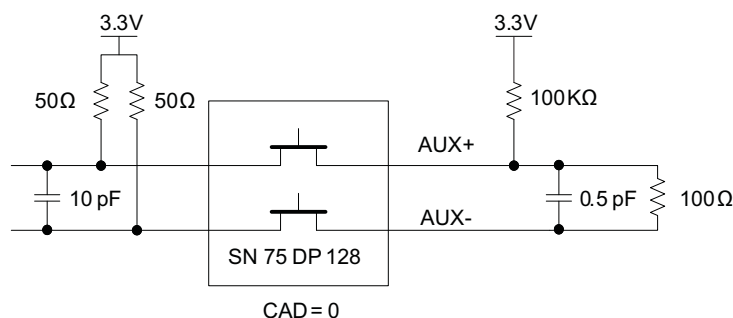


Figure 5. Auxiliary Channel Test Circuit (CAD = LOW)

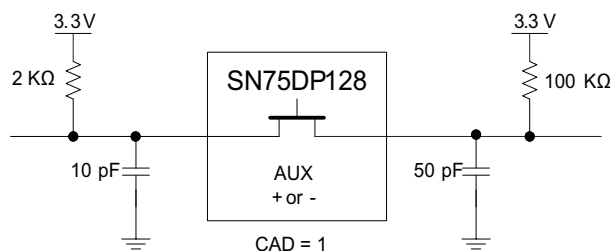
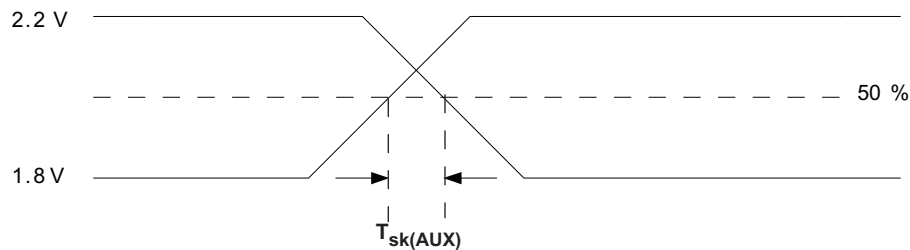
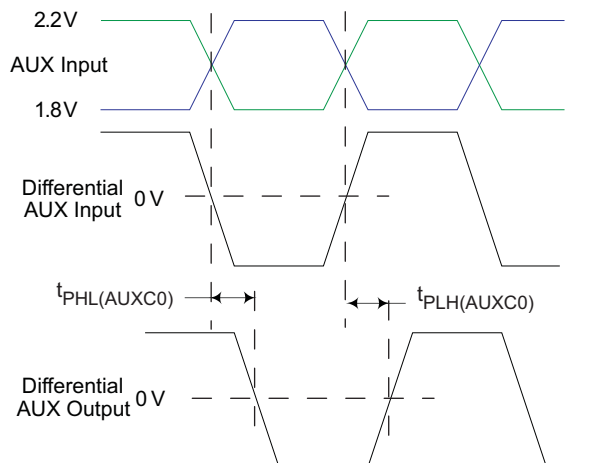


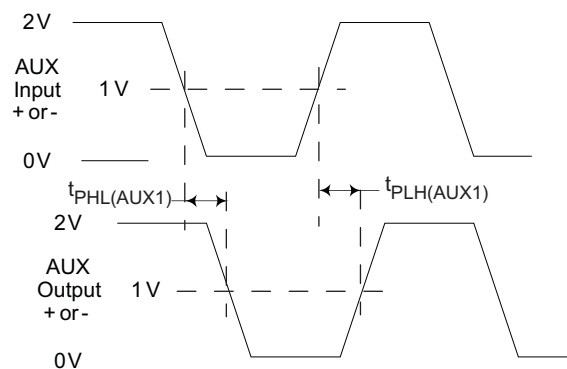
Figure 6. Auxiliary Channel Test Circuit (CAD = HIGH)



**Figure 7. Auxiliary Channel Skew Measurement**



**Figure 8. Auxiliary Channel Delay Measurement (CAD = LOW)**



**Figure 9. Auxiliary Channel Delay Measurement (CAD = HIGH)**

## Main Link Pins

The SN75DP128 is designed to support the 1:2 switching of DisplayPort's high speed differential main link. The main link I/O of the SN75DP128 are designed to track the magnitude and frequency characteristics of the input waveform and replicate them on the output. A feature has also been incorporated in the SN75DP128 to either increase or decrease the output amplitude via the resistor connected between the DPVADJ pin and ground.

## ELECTRICAL CHARACTERISTICS

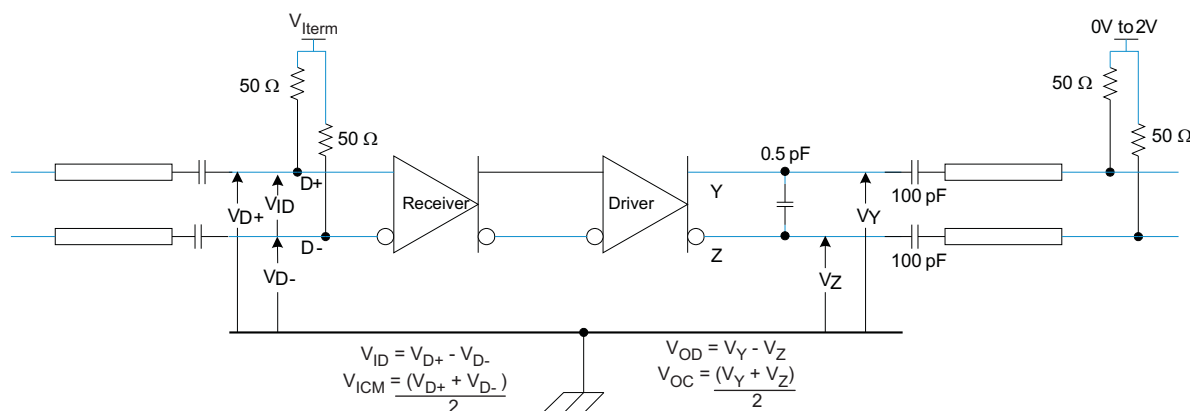
over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$\Delta V_{I/O(2)}$	Difference between input and output voltages ( $V_{OD} - V_{ID}$ )	$V_{ID} = 200 \text{ mV}$ , $DPV_{adj} = 6.5 \text{ k}\Omega$	0	30	60	mV
$\Delta V_{I/O(3)}$		$V_{ID} = 300 \text{ mV}$ , $DPV_{adj} = 6.5 \text{ k}\Omega$	–24	11	36	mV
$\Delta V_{I/O(4)}$		$V_{ID} = 400 \text{ mV}$ , $DPV_{adj} = 6.5 \text{ k}\Omega$	–45	–15	15	mV
$\Delta V_{I/O(6)}$		$V_{ID} = 600 \text{ mV}$ , $DPV_{adj} = 6.5 \text{ k}\Omega$	–87	–47	–22	mV
$R_{INT}$	Input termination impedance		45	50	55	$\Omega$
$V_{Iterm}$	Input termination voltage		0		2	V

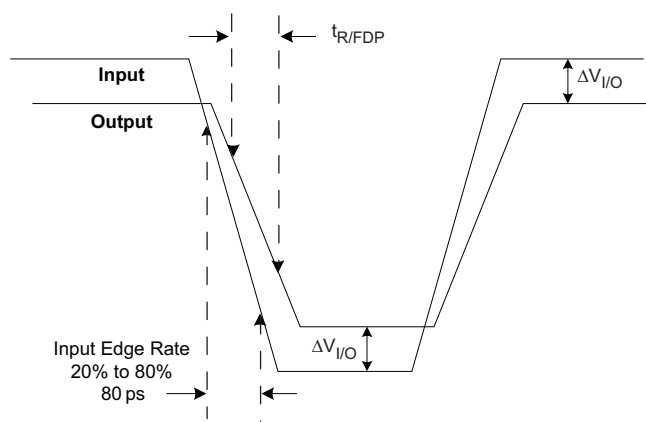
## SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{R/F(DP)}$	Output edge rate (20%–80%)	Input edge rate = 80 ps (20%–80%)		115	160	ps
$t_{PD}$	Propagation delay time	$F = 1 \text{ MHz}$ , $V_{ID} = 400 \text{ mV}$	200	240	280	ps
$t_{SK(1)}$	Intra-pair skew	$F = 1 \text{ MHz}$ , $V_{ID} = 400 \text{ mV}$			20	ps
$t_{SK(2)}$	Inter-pair skew	$F = 1 \text{ MHz}$ , $V_{ID} = 400 \text{ mV}$			40	ps
$t_{DPJIT(PP)}$	Peak-to-peak output residual jitter	$d_R = 2.7 \text{ Gbps}$ , $V_{ID} = 400 \text{ mV}$ , PRBS 27-1		25	35	ps



**Figure 10. Main Link Test Circuit**



**Figure 11. Main Link  $\Delta V_{I/O}$  and Edge Rate Measurements**

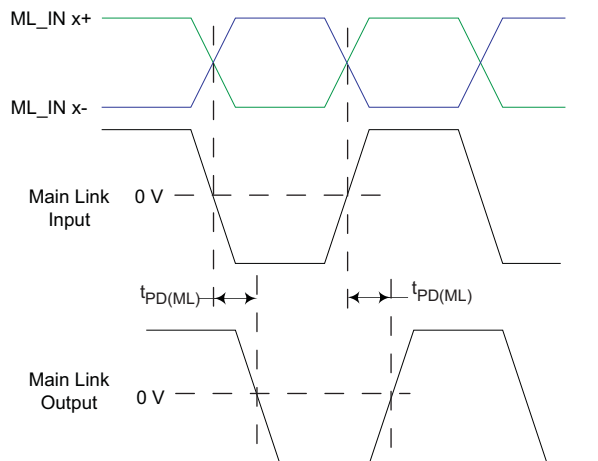


Figure 12. Main Link Delay Measurements

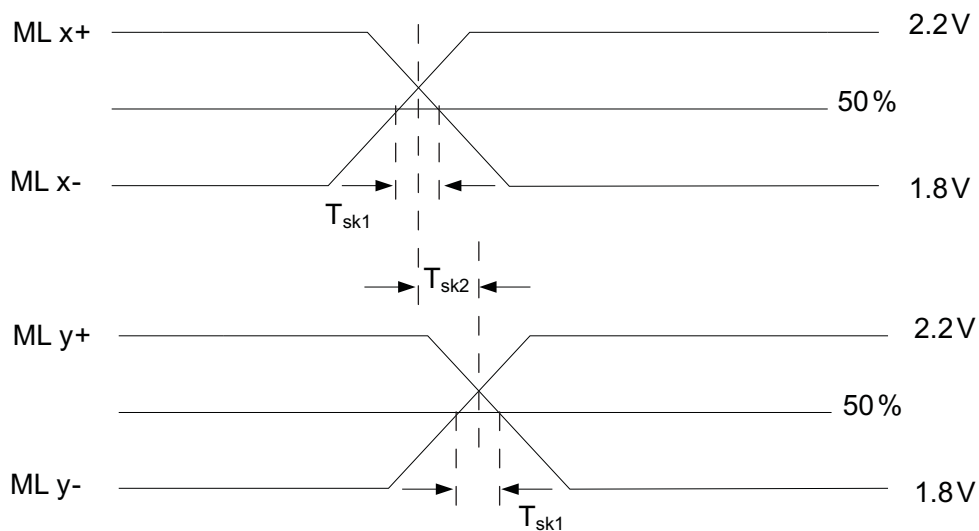


Figure 13. Main Link Skew Measurements

## TYPICAL CHARACTERISTICS

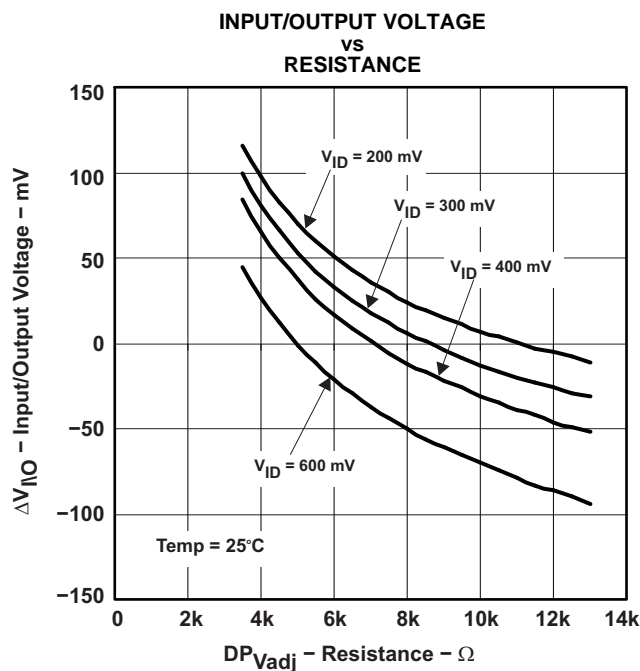


Figure 14.

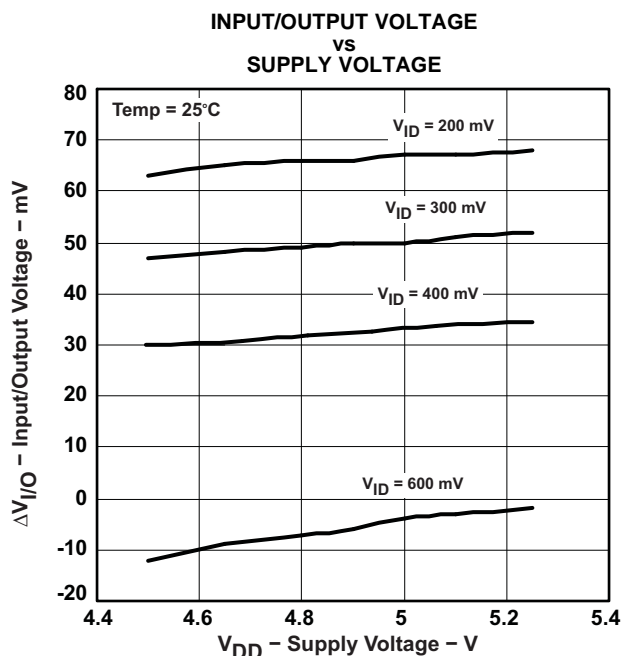


Figure 15.

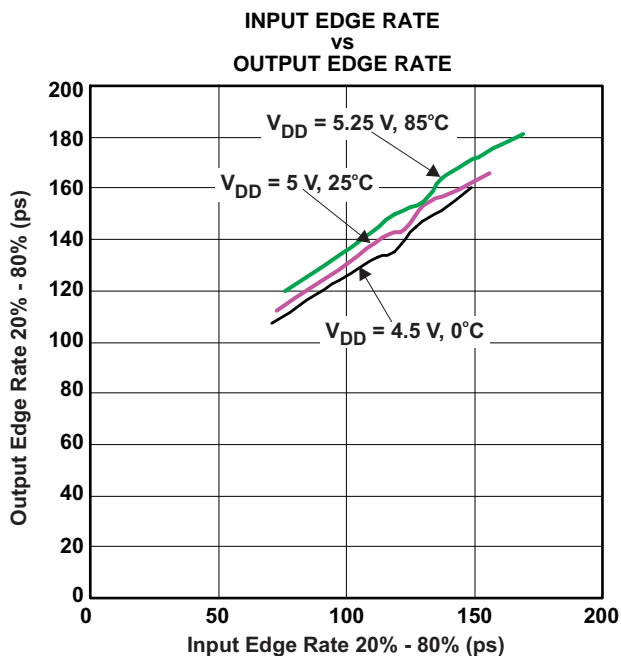


Figure 16.

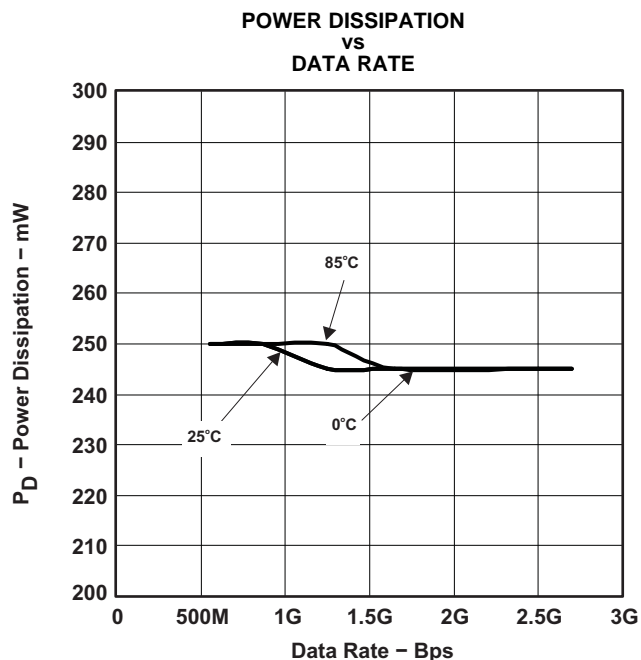


Figure 17.

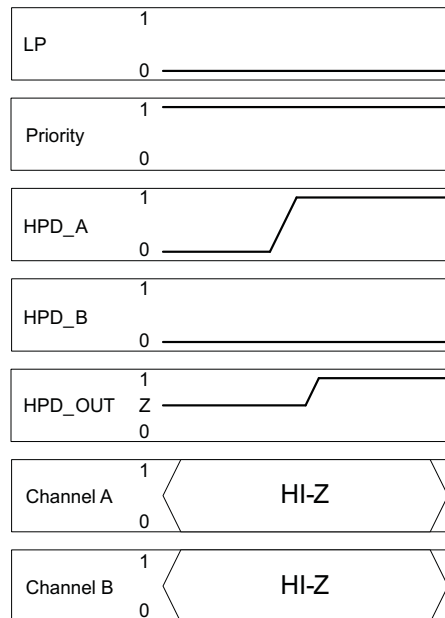
## APPLICATION INFORMATION

### SWITCHING LOGIC

The switching logic of the SN75DP128 is tied to the state of the HPD input pins as well as the priority pin and low power pin. When both HPD\_A and HPD\_B input pins are LOW, the SN75DP128 enters the low power state. In this state the outputs are high impedance, and the device is shutdown to optimize power conservation. When either HPD\_A or HPD\_B goes high, the device enters the normal operational state, and the port associated with the HPD pin that went high is selected. If both HPD\_A and HPD\_B are HIGH, the port selection is determined by the state of the priority pin.

Several key factors were taken into consideration with this digital logic implementation of channel selection as well as HPD repeating. This logic has been divided into the following four scenarios.

1. Low power state to active state. There are two possible cases for this scenario depending on the state of the low power pin:
  - Case one: In this case both HPD inputs are initially LOW and the low power pin is also LOW. In this initial state the device is in a low power mode. Once one of the HPD inputs goes to a HIGH state, the device remains in the low power mode with both the main link and auxiliary I/O in a high impedance state. However, the port associated with the HPD input that went HIGH is still selected and the HPD output to the source is enabled and follows the logic state of the input HPD (see [Figure 18](#)). The state of the Priority pin has no effect in this scenario as only one HPD input port is active.



**Figure 18.**

- Case two: In this case both HPD inputs are initially LOW and the low power pin is HIGH. In this initial state the device is in a low power mode. Once one of the HPD inputs goes to a HIGH state, the device comes out of the low power mode and enters active mode enabling the main link and auxiliary I/O. The port associated with the HPD input that went HIGH is selected and the HPD output to the source is enabled and follows the logic state of the input HPD (see [Figure 19](#)). This is specified as  $t_{Z(HPD)}$ . Again, the state of the Priority pin has no effect in this scenario as only one HPD input port is active.

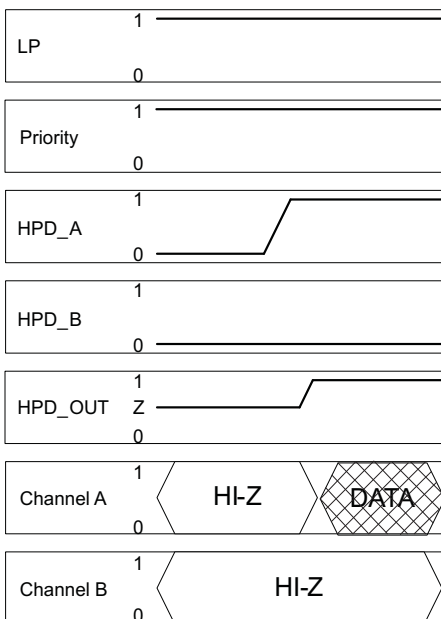


Figure 19.

2. HPD Changes on the selected port. There are also two possible starting cases for this scenario:

- Case one: In this case only one HPD input is initially HIGH. The HPD output logic state follows the state of the HPD input. If the HPD input pulses LOW, as may be the case if the Sink device is requesting an interrupt, the HPD output to the source also pulses LOW for the same duration of time with a slight delay (see Figure 20). The delay of this signal through the SN75DP128 is specified as  $t_{PD(HPD)}$ . If the duration of the LOW pulse is less than  $t_{M(HPD)}$ , it may not be accurately repeated to the source. If the duration of the LOW pulse exceeds  $t_{T2(HPD)}$ , the device assumes that an unplug event has occurred and enters the low power state (see Figure 21). Once the HPD input goes high again, the device returns to the active state as indicated in scenario 1. The state of the Priority pin has no effect in this scenario as only one HPD input port is active.

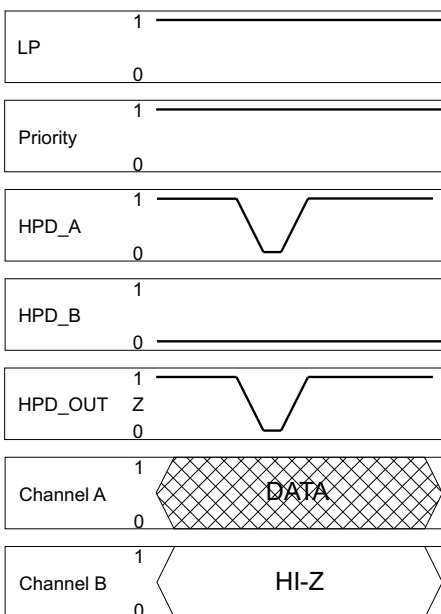
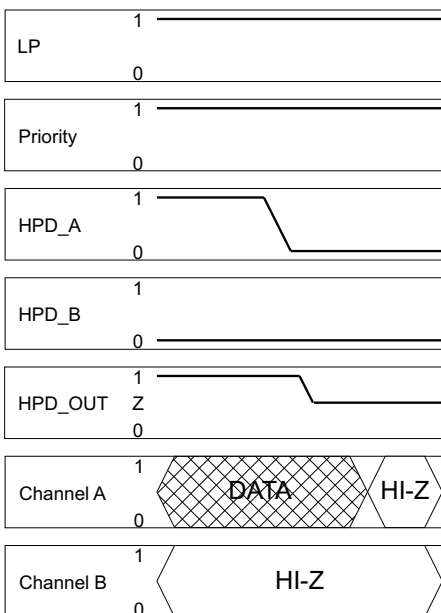
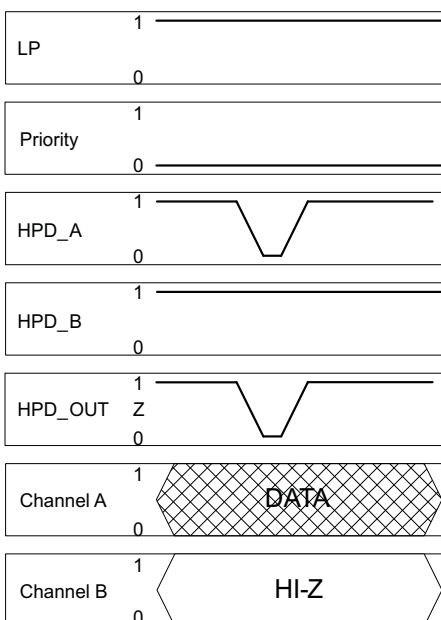


Figure 20.

**Figure 21.**

- Case two: In this case both HPD inputs are initially HIGH and the selected port has been determined by the state of the priority pin. The HPD output logic state follows the state of the selected HPD input. If the HPD input pulses LOW, the HPD output to the source also pulses LOW for the same duration of time, again with a slight delay (see Figure 22). If the duration of the LOW pulse exceeds  $t_{T2(HPD)}$ , the device assumes that an unplug event has occurred and the other port is selected (see Figure 23). The case in which the previously selected port with priority goes high again is covered in scenario 3.

**Figure 22.**



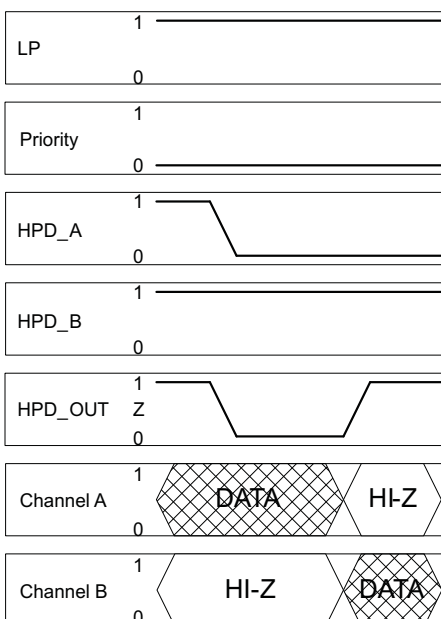


Figure 23.

3. One channel becomes active while other channel is already selected. There are also two possible starting cases for this scenario:
  - Case one: In this case the HPD input that is initially HIGH is from the port that has priority. Since the port with priority is already selected, any activity on the HPD input from the other port doesnot have any effect on the switch whatsoever (see [Figure 24](#)).

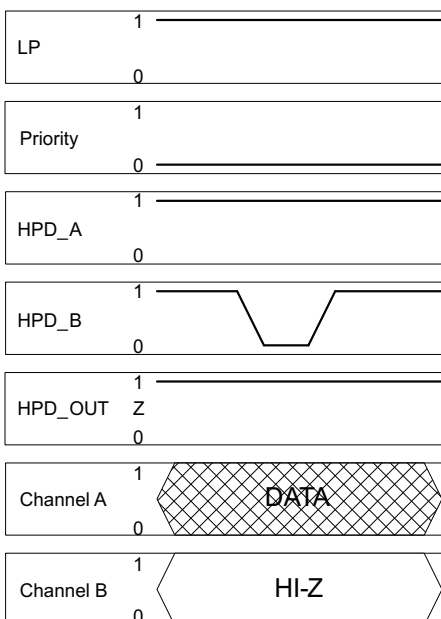
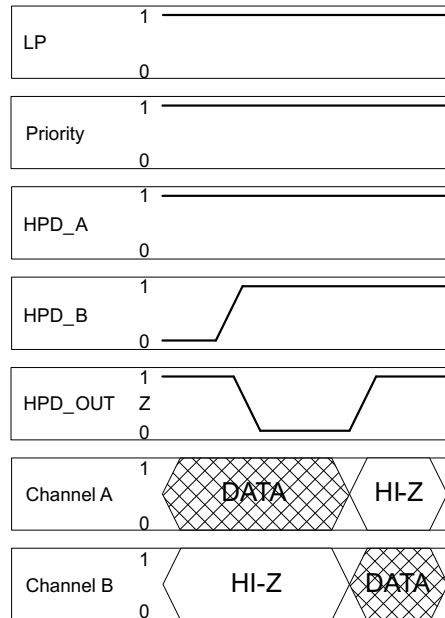


Figure 24.

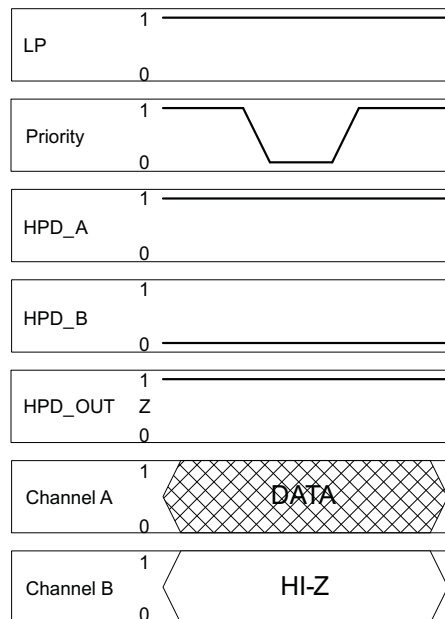
- Case two: In this case the HPD input that is initially HIGH is not the port with priority. When the HPD input of the port that has priority goes high, the HPD output is forced LOW for some time in order to simulate an unplug event to the source device. The duration of this LOW output is defined as  $t_{T2(HPD)}$ . If the HPD input of the port with priority pulses LOW for a short duration while the  $t_{T2(HPD)}$  timer is counting down, the timer is reset. Once this time has passed the switch switches to the port with priority and the output HPD

once again follows the state of the newly selected channel's HPD input (see Figure 25).



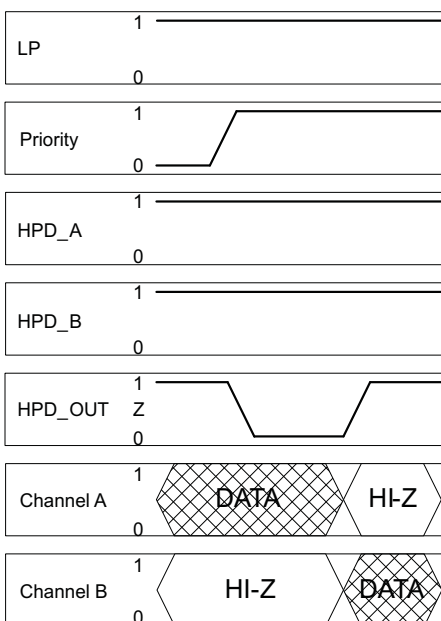
**Figure 25.**

4. 4. Priority pin is toggled. There are also two possible starting cases for this scenario:
  - Case one: In this case only one HPD input is HIGH. A port whose HPD input is LOW cannot be selected. In this case, the state of the priority pin has no effect on the switch (see Figure 26).



**Figure 26.**

- Case two: In this case both HPD inputs are HIGH. Changing the state of the priority pin when both HPD inputs are high forces the device to switch which channel is selected. When a state change is detected on the priority pin, the device waits for a short period of time  $t_{T1(HPD)}$  before responding (see Figure 27). The purpose for this pause is to allow for the priority signal to settle and also to allow the device to ignore potential glitches on the priority pin. Once  $t_{T1(HPD)}$  has expired, the HPD output is forced LOW for  $t_{T2(HPD)}$  and the device follows the chain of events outlined in scenario 3 case 2.



**Figure 27.**

## 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
SN75DP128RTQR	NRND	QFN	RTQ	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	0 to 85	DP128	
SN75DP128RTQRG4	NRND	QFN	RTQ	56	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	0 to 85	DP128	
SN75DP128RTQT	NRND	QFN	RTQ	56	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	0 to 85	DP128	
SN75DP128RTQTG4	NRND	QFN	RTQ	56	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	0 to 85	DP128	

(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.

**OBSELETE:** 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) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**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
SN75DP128RTQR	QFN	RTQ	56	2000	330.0	16.4	8.3	8.3	2.25	12.0	16.0	Q2
SN75DP128RTQT	QFN	RTQ	56	250	180.0	16.4	8.3	8.3	2.25	12.0	16.0	Q2

## TAPE AND REEL BOX DIMENSIONS

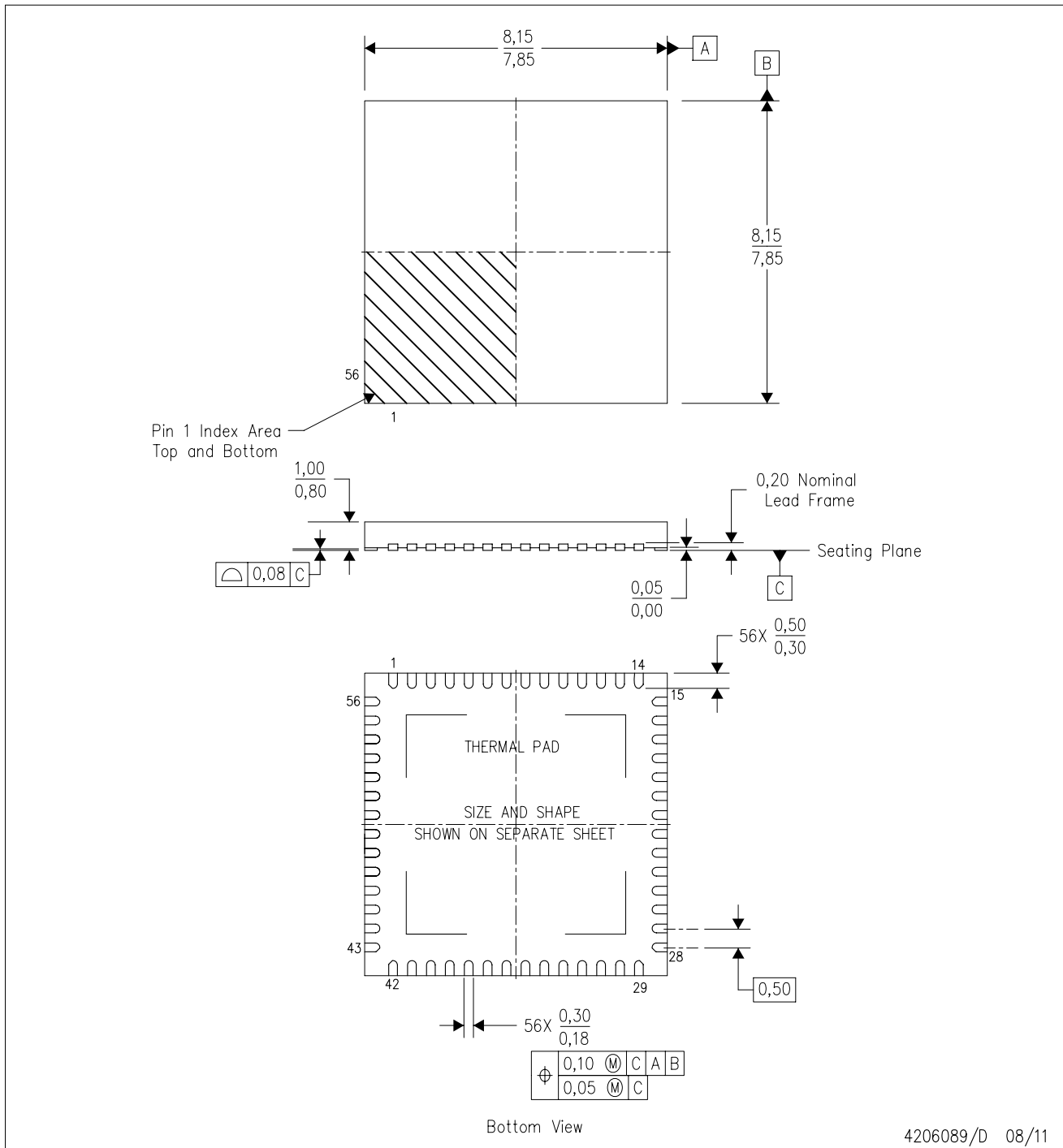


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75DP128RTQR	QFN	RTQ	56	2000	367.0	367.0	38.0
SN75DP128RTQT	QFN	RTQ	56	250	210.0	185.0	35.0

RTQ (S-PVQFN-N56)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) Package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - F. Package complies to JEDEC MO-220.



RTQ (S-PVQFN-N56)

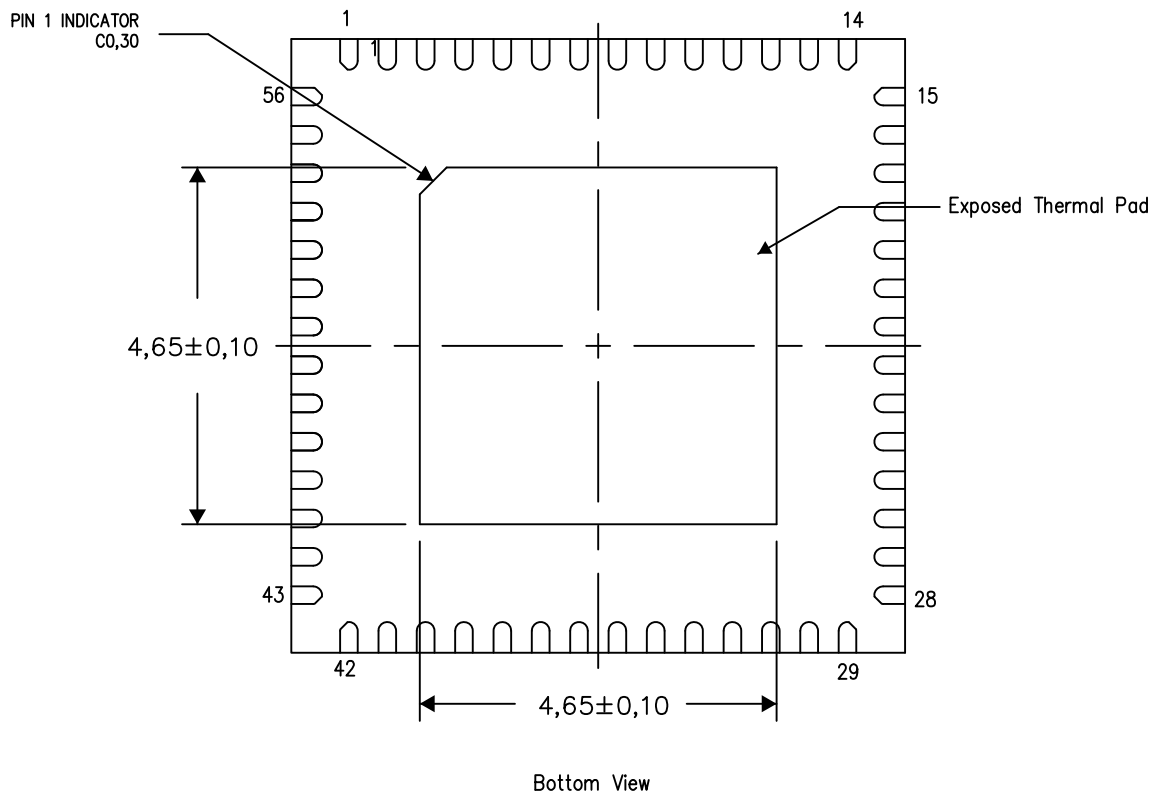
PLASTIC QUAD FLATPACK NO-LEAD

## THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



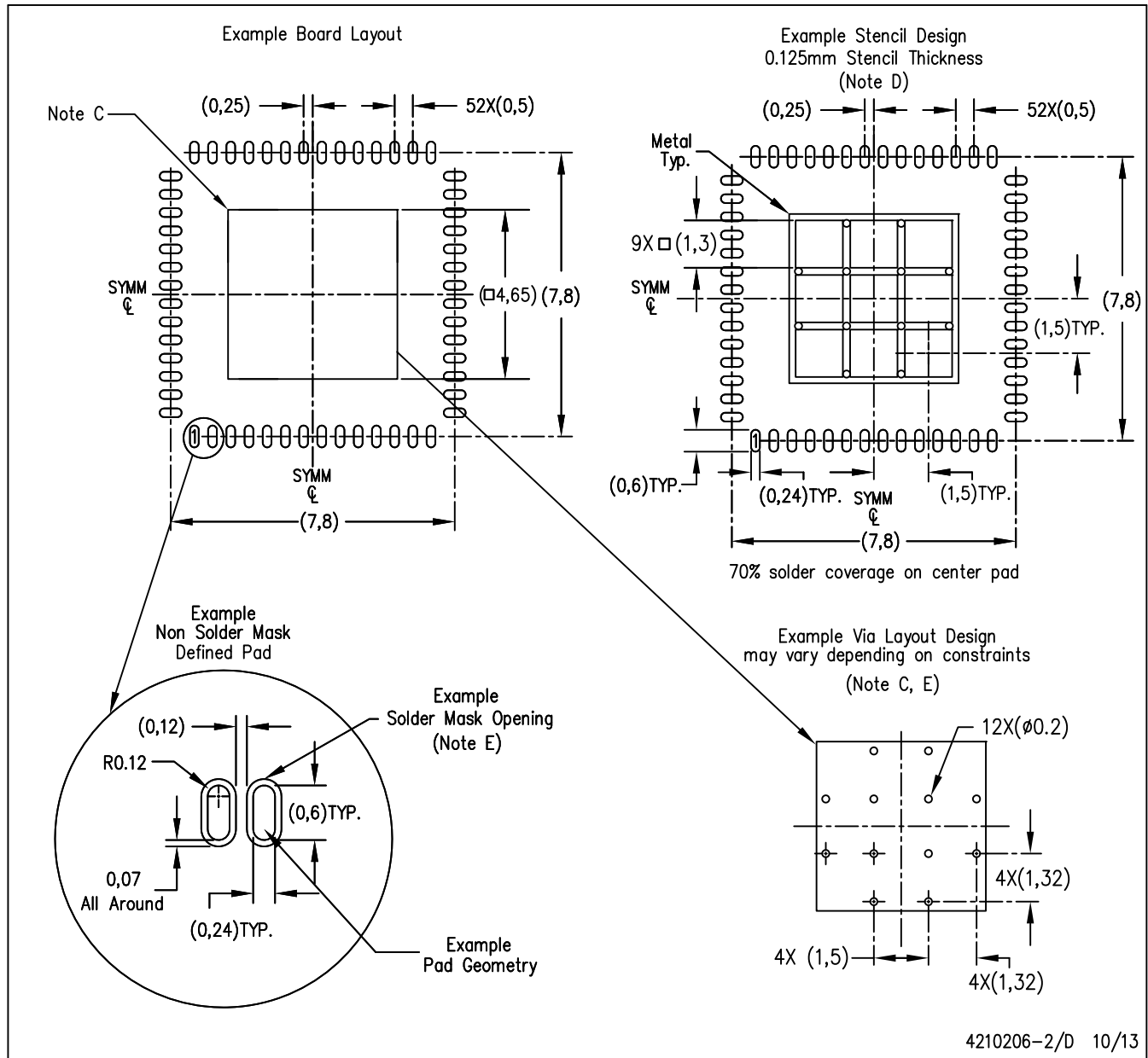
Exposed Thermal Pad Dimensions

4206252-4/P 10/13

NOTE: All linear dimensions are in millimeters

RTQ (S-PVQFN-N56)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack Packages, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - Customers should contact their board fabrication site for recommended solder mask tolerances and via tenting recommendations for vias placed in thermal pad.

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