

## DisplayPort 1:2 Switch With Integrated TMDS Translator

### FEATURES

- One Input Port to One of Two Output Ports
- Integrated TMDS Level Translator with Receiver Equalization
- DP Port Supports Data Rates up to 2.7 Gbps
- DP Port Supports Dual-Mode DisplayPort
- DP Port Output Waveform Mimics Input Waveform Characteristics
- TMDS Port Supports Data Rates up to 2.5 Gbps
- Integrated I<sup>2</sup>C Logic Block for DVI/HDMI Connector Recognition
- Enhanced ESD:
  - 12 kV on all High Speed Pins
  - 8 kV on all Auxiliary and I<sup>2</sup>C 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

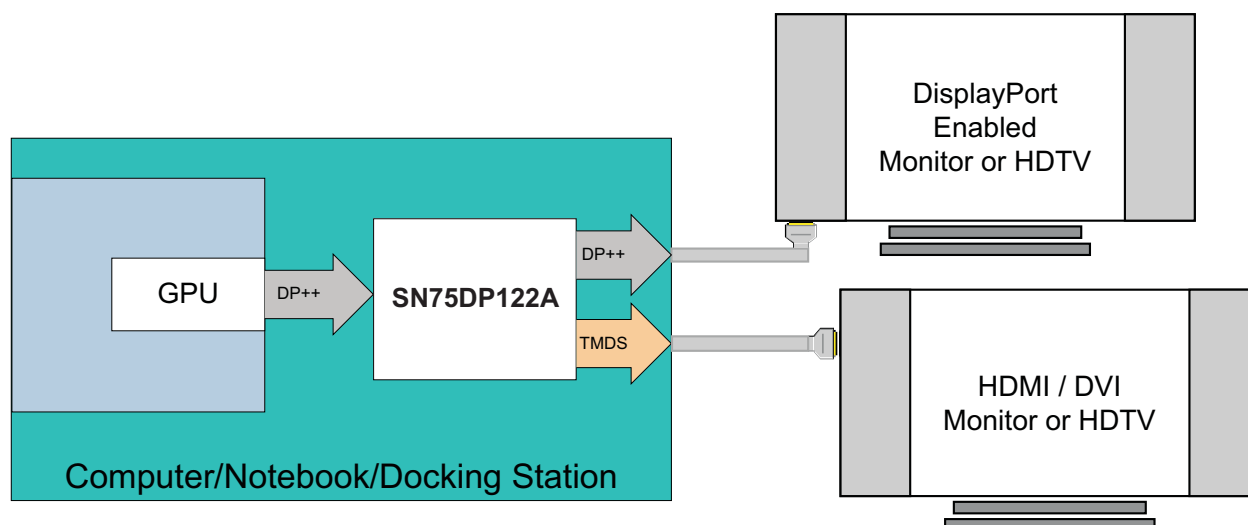
### DESCRIPTION

The SN75DP122A is a one Dual-Mode DisplayPort input to one Dual-Mode DisplayPort output or one TMDS output. The TMDS output has a built in level translator compliant with Digital Video Interface (DVI) 1.0 and High Definition Multimedia Interface (HDMI) 1.3b. The DisplayPort output follows 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 SN75DP122A data rates of up to 2.7 Gbps through each link for a total throughput of up to 10.8 Gbps can be realized. The SN75DP122A supports Display Port Spec 1.1a

In addition to the switching of the DisplayPort high speed signal lines, the SN75DP122A also supports the switching of the bidirectional auxiliary (AUX), Hot Plug Detect (HPD), and Cable Adapter Detect (CAD) channels. The Auxiliary differential pair supports Dual-Mode DisplayPort operation through the DisplayPort port. Through the TMDS port the auxiliary port is configured as an I<sup>2</sup>C port with an integrated I<sup>2</sup>C repeater.

The SN75DP122A is characterized for operation over ambient air temperature of 0°C to 85°C.

### TYPICAL APPLICATION

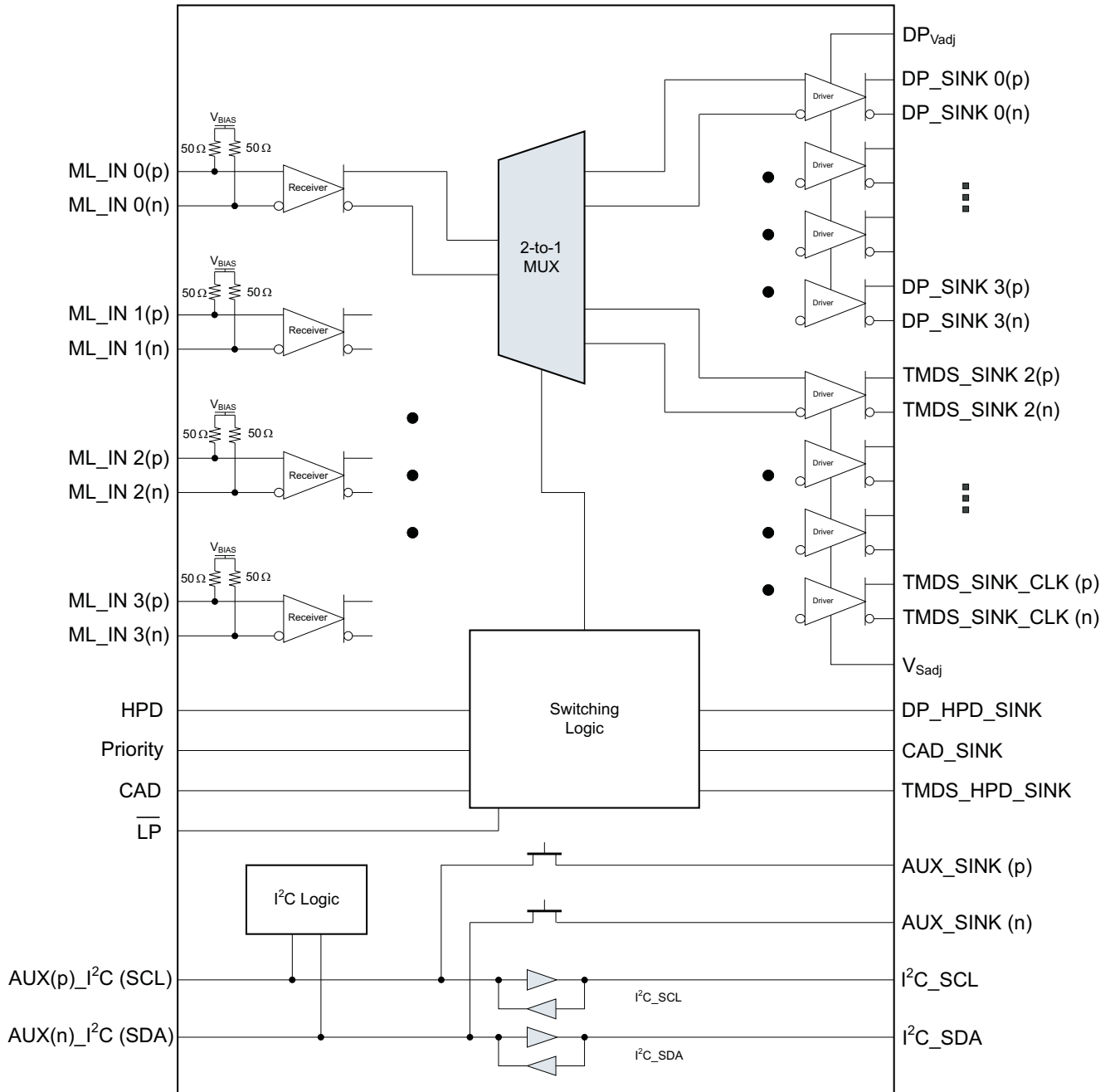


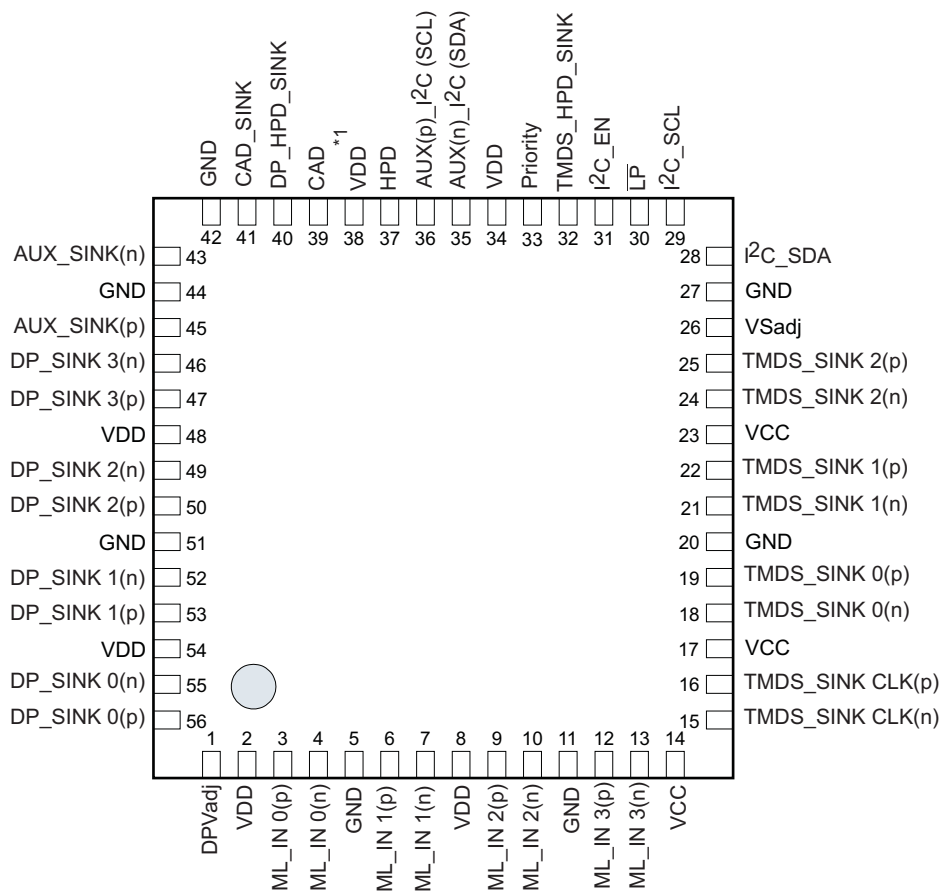
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



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			
DP_SINK 0	56, 55	O	DisplayPort main link port a channel 0 differential output
DP_SINK 1	53, 52	O	DisplayPort main link port a channel 1 differential output
DP_SINK 2	50, 49	O	DisplayPort main link port a channel 2 differential output
DP_SINK 3	47, 46	O	DisplayPort main link port a channel 3 differential output
MAIN LINK PORT B OUTPUT PINS			
TMDS_SINK 2	25, 24	O	TMDS data 2 differential output
TMDS_SINK 1	22, 21	O	TMDS data 1 differential output
TMDS_SINK 0	19, 18	O	TMDS data 0 differential output
TMDS_SINK CLK	16, 15	O	TMDS data clock differential output
HOT PLUG DETECT PINS			
HPD	37	O	Hot plug detect output to the displayport source
DP_HPD_SINK	40	I	DisplayPort port hot plug detect input
TMDS_HPD_SINK	32	I	TMDS port hot plug detect input
AUXILIARY DATA PINS			
AUX_I <sup>2</sup> C	36, 35	I/O	Source side bidirectional displayport auxiliary data line
AUX_SINK	45, 43	I/O	DisplayPort port bidirectional displayport auxiliary data line
I <sup>2</sup> C_SCL I <sup>2</sup> C_SDA	29, 28	I/O	TMDS port bidirectional ddc data lines
CABLE ADAPTER DETECT PINS			
CAD	39	O	Cable adapter detect output to the displayport source
CAD_SINK	41	I	DisplayPort cable adapter detect input
CONTROL PINS			
$\overline{\text{LP}}$	30	I	Low power select bar
Priority	33	I	Output port priority selection
DPVadj	1	I	DisplayPort main link output gain adjustment
VSadj	26	I	TMDS compliant voltage swing control
I <sup>2</sup> C_EN	31	I	Internal I <sup>2</sup> C register enable, used for HDMI / DVI connector differentiation
SUPPLY and GROUND PINS			
VDD	2, 8, 34, 48, 54		5-V supply
VDD <sup>*1</sup>	38		HPD/CAD supply
VCC	14, 17, 23		3.3-V supply
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	TMDS Port has Priority	If both DP_HPD_SINK and TMDS_HPD_SINK are high, the TMDS port is selected
	L	DP Port has Priority	If both DP_HPD_SINK and TMDS_HPD_SINK are high, the DP port is selected
$\text{I}^2\text{C\_EN}$	H	HDMI	The Internal $\text{I}^2\text{C}$ register is active and readable when the TMDS port is selected indicating that the connector being used is HDMI
	L	DVI	The Internal $\text{I}^2\text{C}$ register is disabled and not readable when the TMDS port is selected indicating that the connector being used is DVI
$\text{DP}_{\text{Vadj}}$	4.53 k $\Omega$	Increased Gain	Main link displayport output has an increased voltage swing
	6.49 k $\Omega$	Nominal Gain	Main link displayport output has a nominal voltage swing
	10 k $\Omega$	Decreased Gain	Main link displayport output has a decreased voltage swing
$\text{VS}_{\text{adj}}$	5.11 k $\Omega$	Compliant Voltage Swing	Driver output voltage swing precision control to aid with system compliance

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

Explanation of the internal switching logic of the SN75DP122A is located in the application section at the end of this data sheet.

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

PART NUMBER	PART MARKING	PACKAGE
SN75DP122ARTQR	75DP122A	56-pin QFN Reel (large)
SN75DP122ARTQT	75DP122A	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>	$V_{\text{DD}}, V_{\text{DD}}^{*1}$	–0.3 to 5.25	V
Supply voltage range	$V_{\text{CC}}$	–0.3 to 3.6	V
Voltage range	Main Link I/O (ML_IN x, DP_SINK x) Differential Voltage	1.5	V
	TMDS I/O	–0.3 to 4	V
	HPD and CAD I/O	–0.3 to 5.25	V
	Auxiliary I/O	–0.3 to 5.25	V
	Control I/O	–0.3 to 5.25	V
Electrostatic discharge	Human body model <sup>(3)</sup>	Auxiliary and $\text{I}^2\text{C}$ I/O	±8000
		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	$T_A < 25^\circ\text{C}$	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/ $^\circ\text{C}$	1449 mW
	High-K	1109 mW	11.03 mW/ $^\circ\text{C}$	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		$^\circ\text{C}/\text{W}$
$R_{\theta JC}$ Junction-to-case thermal resistance			20.4		$^\circ\text{C}/\text{W}$
$P_{D(1)}$ Device power dissipation DisplayPort selected	$\overline{LP} = 5\text{ V}$ , ML: $V_{ID} = 600\text{ mV}$ , 2.7 Gbps PRBS; AUX: $V_{ID} = 500\text{ mV}$ , 1 Mbps PRBS; HPD/CAD = 5 V; $V_{DD}^{*1} = V_{DD}$		250	305	mW
$P_{D(2)}$ Device power dissipation TMDS selected	$\overline{LP} = 5\text{ V}$ , ML: $V_{ID} = 500\text{ mV}$ , 2.5 Gbps PRBS; $I^2C$ : $V_{ID} = 3.3\text{ V}$ , 100 Kbps PRBS; HPD/CAD = 5 V; $V_{DD}^{*1} = V_{DD}$		270	420	mW
$P_{SD}$ Device power dissipation under low power	$\overline{LP} = 0\text{ V}$ , ML: $V_{ID} = 600\text{ mV}$ , 2.7 Gbps PRBS; AUX: $V_{ID} = 500\text{ mV}$ , 1 Mbps PRBS; HPD/CAD = 5 V; $V_{DD}^{*1} = V_{DD}$		75	85	$\mu\text{W}$

(1) The maximum rating is simulated under 5.25 V VDD.

## 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
$V_{CC}$ Supply voltage	3	3.3	3.6	V
$T_A$ Operating free-air temperature	0		85	$^\circ\text{C}$
<b>MAIN LINK DIFFERENTIAL PINS</b>				
$V_{ID}$ Peak-to-peak input differential voltage	0.15		1.40	V
$d_R$ Data rate			2.7	Gbps
$R_t$ Termination resistance	45	50	55	$\Omega$
$V_{Oterm}$ Output termination voltage	0		2	V
<b>TMDS DIFFERENTIAL OUTPUT PINS</b>				
$AV_{CC}$ TMDS output termination voltage	3	3.3	3.6	V
$d_R$ Data rate			2.5	Gbps
$R_t$ Termination resistance	45	50	55	$\Omega$
<b>AUXILIARY AND <math>I^2C</math> PINS</b>				
$V_I$ Input voltage	0		5.25	V
$d_{R(AUX)}$ Auxiliary data rate			1	MHz
$d_{R(I2C)}$ $I^2C$ data rate			100	kHz
<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 SN75DP122A is designed to operate off of two supply voltages. The DisplayPort port and the digital logic run off of the 5V supply voltage. The TMDS level translator is powered off of the 3.3V supply.

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{DD}$	Supply current	LP = 5 V, $V_{DD}^{*1} = V_{DD}$ , Priority = 0 V ML: $V_{ID} = 600$ mV, 2.7 Gbps PRBS AUX: $V_{ID} = 500$ mV, 1 Mbps PRBS DP/TMDS_HPD_SINK and CAD_SINK = 5 V		60	65	mA
$I_{CC}$				0.1	0.25	
$I_{DD(2)}$	Supply current	LP = 5 V, $V_{DD}^{*1} = V_{DD}$ , Priority = 1 V ML: $V_{ID} = 500$ mV, 2.5 Gbps PRBS AUX: $V_I = 2$ V, 100 kHz DP/TMDS_HPD_SINK and CAD_SINK = 5 V		2	4	mA
$I_{CC(2)}$				80	110	
$I_{DD}^{*1}$	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 SN75DP122A is designed to support the switching of the Hot Plug Detect and Cable adapter Detect signals. The SN75DP122A 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.

When the DisplayPort port is selected, the state of CAD\_SINK is propagated to the CAD output pin. If the TMDS port is selected, the CAD output pin stays HIGH as long as that port is selected.

Explanation of HPD and the internal logic of the SN75DP122A 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

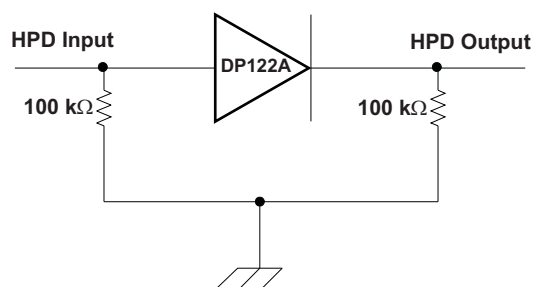


Figure 1. HPD Test Circuit

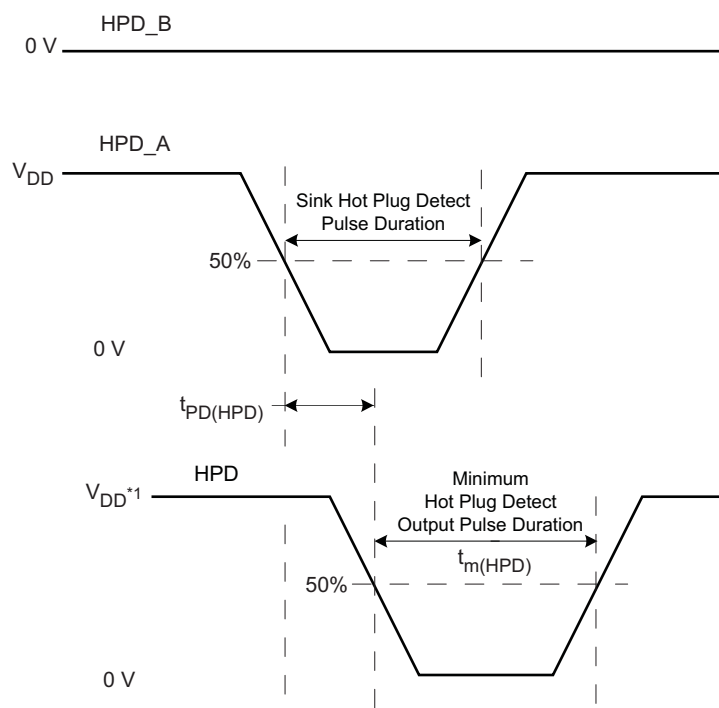
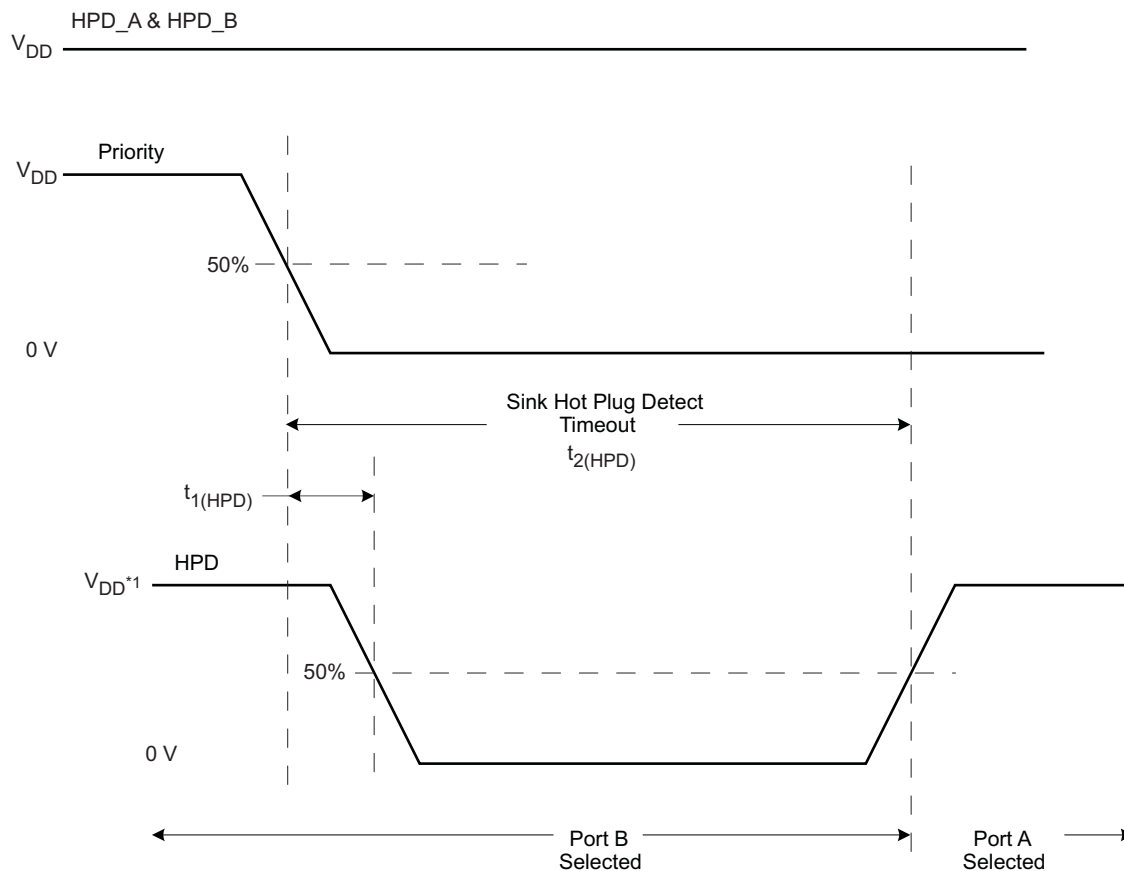
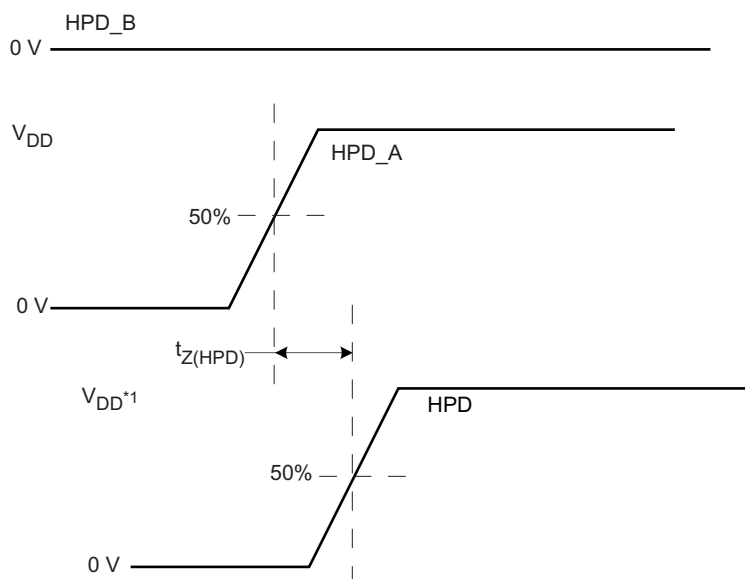


Figure 2. HPD Timing Diagram #1



**Figure 3. HPD Timing Diagram #2**



**Figure 4. HPD Timing Diagram #3**

## DisplayPort Auxiliary Pins

The SN75DP122A is designed to support the bidirectional auxiliary signals through the DisplayPort port 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 CAD\_SINK 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		4.2	V
$I_{OZ}$ Output current from unselected output	$V_{DD} = 5.25\text{ V}$ , $V_O = 0\text{ V}$ to $3.6\text{ V}$ , $V_I = 0\text{ V}$	–5		5	$\mu\text{A}$
$C_{IO(off)}$ I/O capacitance when in low power	DC bias = $1\text{ V}$ , AC = $1.4\text{ V}_{p-p}$ , $F = 100\text{ kHz}$ , CAD = High		9	12	pF
$C_{IO(on)}$ I/O capacitance when in normal operation	DC bias = $1\text{ V}$ , AC = $1.4\text{ V}_{p-p}$ , $F = 100\text{ kHz}$ , CAD = Low		18	25	pF
$r_{ON(C0-AUX+)}$ On resistance AUX+	$V_{DD} = 4.5\text{ V}$ , $V_I = 0\text{ V}$ , $I_O = 5\text{ mA}$ , CAD = Low		5	10	$\Omega$
$r_{ON(C0-AUX-)}$ On resistance AUX-	$V_{DD} = 4.5\text{ V}$ , $V_I = 3.6\text{ V}$ , $I_O = 5\text{ mA}$ , CAD = Low		5	10	$\Omega$
$r_{ON(C1)}$ On resistance	$V_{DD} = 4.5\text{ V}$ , $V_I = 0.4\text{ V}$ , $I_O = 3\text{ mA}$ , CAD = High		10	18	$\Omega$
$V_{AUX+}$ Voltage on the AUX+	$V_{DD} = 4.5\text{ V}$ , 100k pullup on AUX+ to $3.3\text{ V} \pm 10\%$ , HPD_SINK = Low	1.48		1.81	V
$V_{AUX-}$ Voltage on the AUX-	$V_{DD} = 4.5\text{ V}$ , 100k pulldown on AUX- to GND, HPD_SINK = Low	1.48		1.81	V

## SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{sk(AUX)}$ Intra-pair skew	$V_{ID} = 400\text{ mV}$ , $V_{IC} = 2\text{ V}$		350	400	ps
$I_{L(AUX)}$ Single Line Insertion Loss	$V_{ID} = 500\text{ mV}$ , $V_{IC} = 2\text{ V}$ , $F = 1\text{ MHz}$ , CAD = Low			0.4	dB
$t_{PLH(AUXC0)}$ Propagation delay time, low to high	CAD = Low, $F = 1\text{ MHz}$			3	ns
$t_{PHL(AUXC0)}$ Propagation delay time, high to low	CAD = Low, $F = 1\text{ MHz}$			3	ns
$t_{PLH(AUXC1)}$ Propagation delay time, low to high	CAD = High, $F = 100\text{ kHz}$			5	ns
$t_{PHL(AUXC1)}$ Propagation delay time, high to low	CAD = High, $F = 100\text{ kHz}$			5	ns

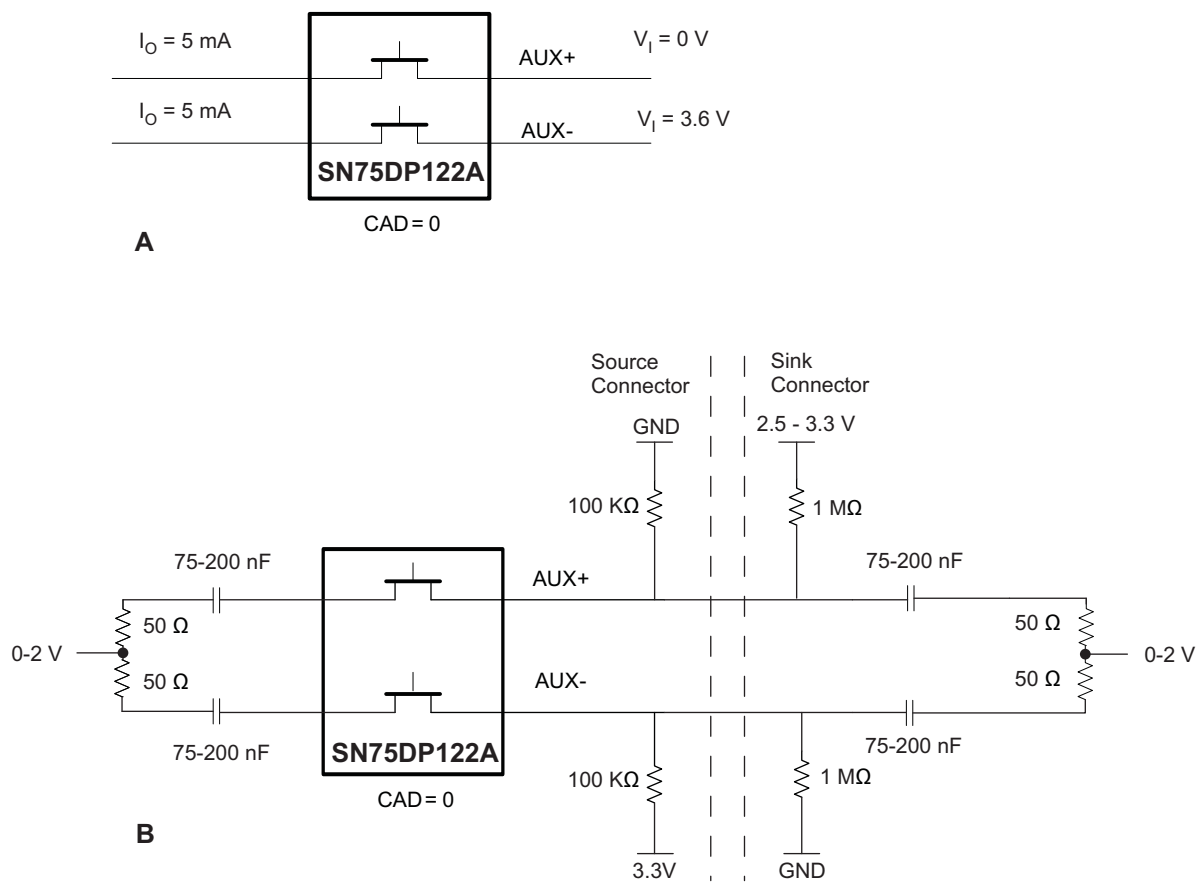


Figure 5. Auxiliary Channel Test Circuit (CAD = LOW)

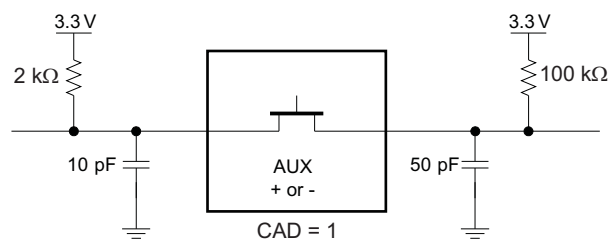


Figure 6. Auxiliary Channel Test Circuit (CAD = HIGH)

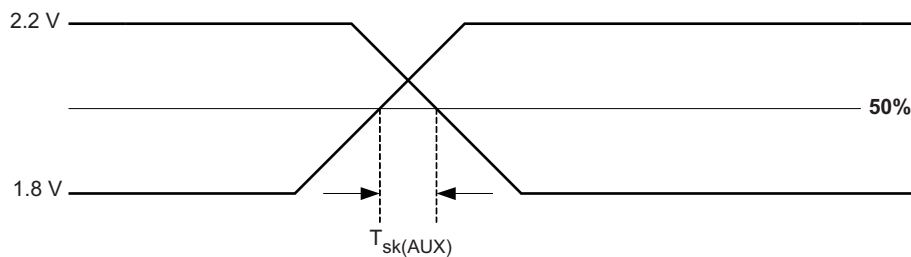
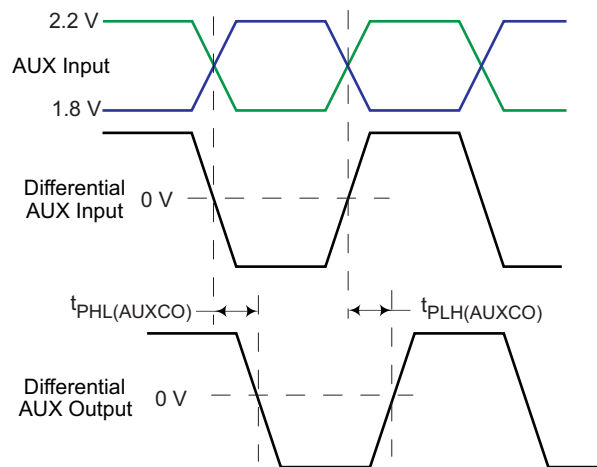
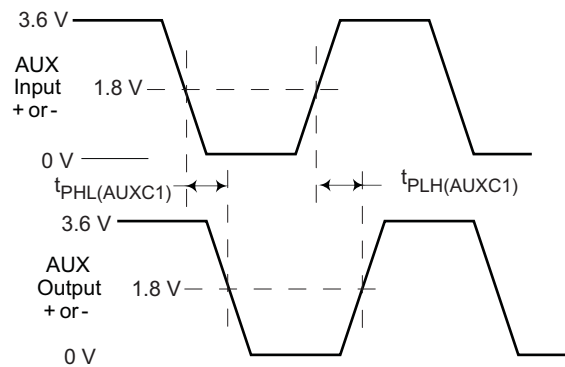


Figure 7. Auxiliary Channel Skew Measurement



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



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

## DisplayPort Link Pins

The SN75DP122A is designed to support DisplayPort's high speed differential main link through the DisplayPort port. The main link I/O of the SN75DP122A 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 SN75DP122A to increase the either increase of decrease the output amplitude via the resistor connected between the DPVADJ pin and ground.

## ELECTRICAL CHARACTERISTICS

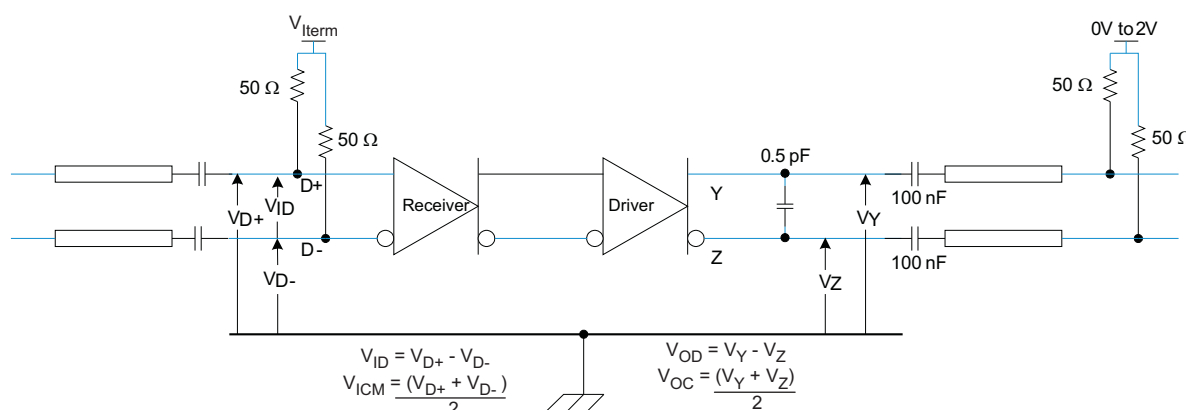
over recommended operating conditions (unless otherwise noted)

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

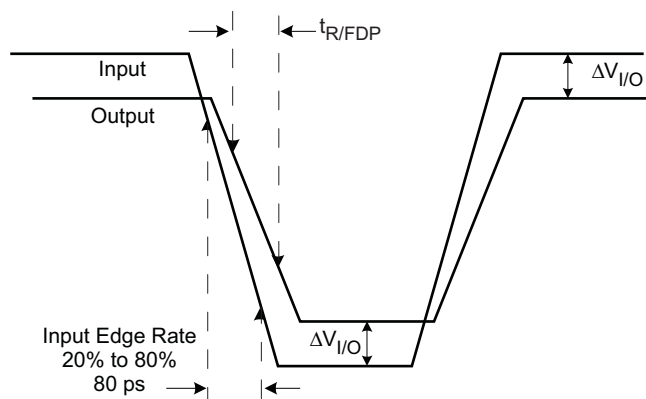
## SWITCHING CHARACTERISTICS

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	$F = 1\text{ MHz}$ , $V_{ID} = 400\text{ mV}$		227		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**

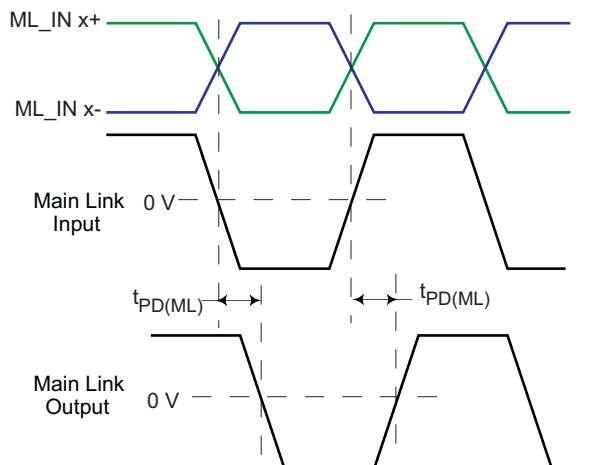


Figure 12. Main Link Delay Measurements

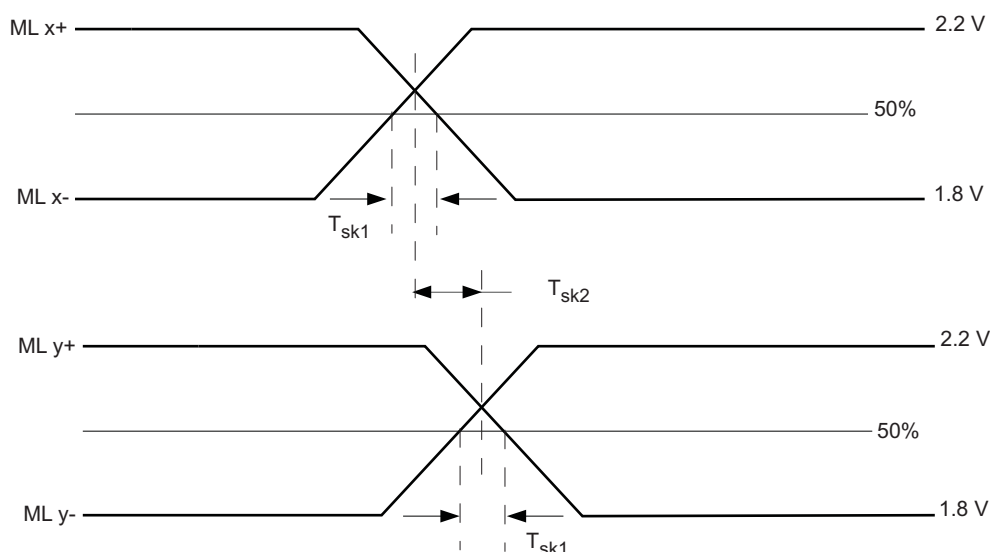


Figure 13. Main Link Skew Measurements

## TMDS I<sup>2</sup>C Pins

When the TMDS port is selected the SN75DP122A utilizes an I<sup>2</sup>C repeater. The repeater is designed to isolate the parasitic effects of the system in order to aid with system level compliance.

In addition to the I<sup>2</sup>C repeater, the SN75DP122A also supports the connector detection I<sup>2</sup>C register. This register is enabled via the I<sup>2</sup>C\_EN pin. When active an internal memory register is readable via the AUX\_I<sup>2</sup>C I/O. The functionality of this register block is described in the application section

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_L$	Low input current	$V_{CC} = 3.6 \text{ V}$ , $V_I = 0 \text{ V}$	-10		10	$\mu\text{A}$
$I_{lkg(AUX)}$	Input leakage	AUX_I <sup>2</sup> C pins $V_{CC} = 3.6 \text{ V}$ , $V_I = 3.6 \text{ V}$	-10		10	$\mu\text{A}$

## ELECTRICAL CHARACTERISTICS (continued)

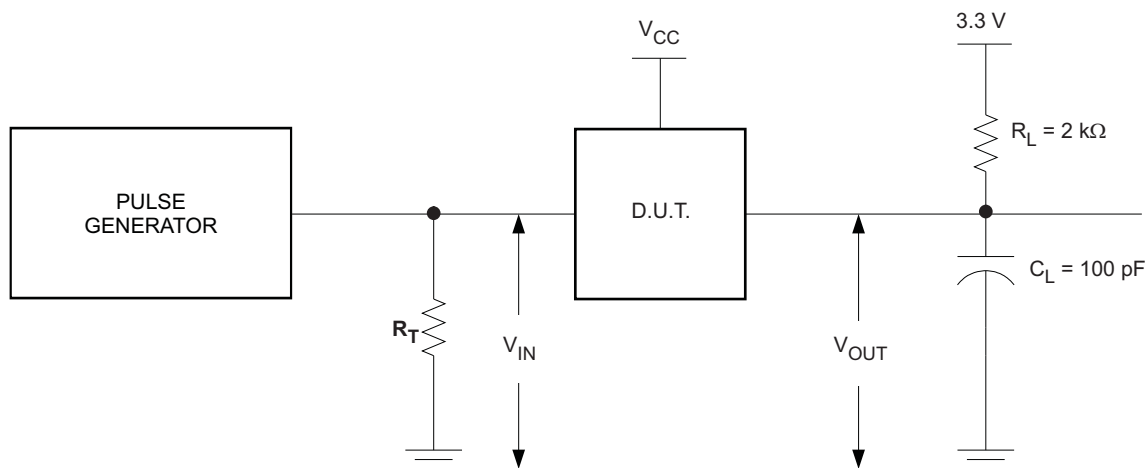
over recommended operating conditions (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
$C_{IO(AUX)}$	Input/output capacitance	AUX_I <sup>2</sup> C pins	DC bias = 1 V, AC = 1.4 V <sub>p-p</sub> , f = 100 kHz			15	pF
$V_{IH(AUX)}$	High-level input voltage	AUX_I <sup>2</sup> C pins		1.6			V
$V_{IL(AUX)}$	Low-level input voltage	AUX_I <sup>2</sup> C pins		−0.2		0.4	V
$V_{OL(AUX)}$	Low-level output voltage	AUX_I <sup>2</sup> C pins	I <sub>O</sub> = 4 mA	0.5		0.6	V
$I_{lk(I2C)}$	Input leakage current	I <sup>2</sup> C SDA/SCL pins	V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = 4.95V	−10		10	μA
$C_{IO(I2C)}$	Input/output capacitance	I <sup>2</sup> C SDA/SCL pins	DC bias = 2.5 V, AC = 3.5 V <sub>p-p</sub> , f = 100 kHz			15	pF
$V_{IH(I2C)}$	High-level input voltage	I <sup>2</sup> C SDA/SCL pins		2.1			V
$V_{IL(I2C)}$	Low-level input voltage	I <sup>2</sup> C SDA/SCL pins		−0.2		1.5	V
$V_{OL(I2C)}$	Low-level output voltage	I <sup>2</sup> C SDA/SCL pins	I <sub>O</sub> = 4 mA			0.2	V

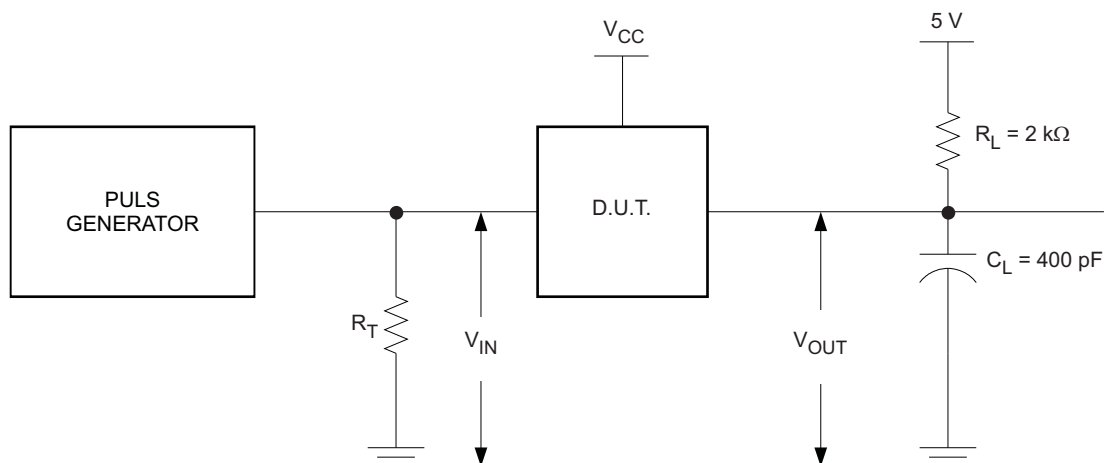
## SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

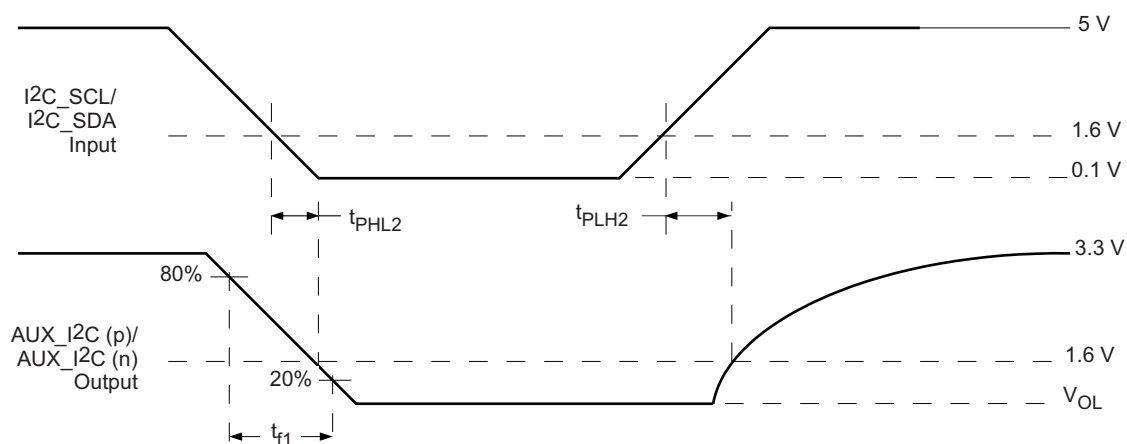
PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH1}$	Propagation delay time, low to high		Source to sink	204		459	ns
$t_{PHL1}$	Propagation delay time, high to low		Source to sink	35		140	ns
$t_{PLH2}$	Propagation delay time, low to high		Sink to source	80		251	ns
$t_{PHL2}$	Propagation delay time, high to low		Sink to source	35		200	ns
$t_{f1}$	Output signal fall time		Sink side	20		72	ns
$t_{f2}$	Output signal fall time		Source side	20		72	ns
$f_{SCL}$	SCL clock frequency for internal register		Source side			100	kHz
$t_{W(L)}$	Clock LOW period for I <sup>2</sup> C register		Source side	4.7			μs
$t_{W(H)}$	Clock HIGH period for internal register		Source side	4.0			μs
$t_{SU1}$	Internal register setup time, SDA to SCL		Source side	250			ns
$t_{h(1)}$	Internal register hold time, SCL to SDA		Source side	0			μs
$T_{(buf)}$	Internal register bus free time between STOP and START		Source side	4.7			μs
$t_{su(2)}$	Internal register setup time, SCL to START		Source side	4.7			μs
$t_{h(2)}$	Internal register hold time, START to SCL		Source side	4.0			μs
$t_{su(3)}$	Internal register hold time, SCL to STOP		Source side	4.0			μs



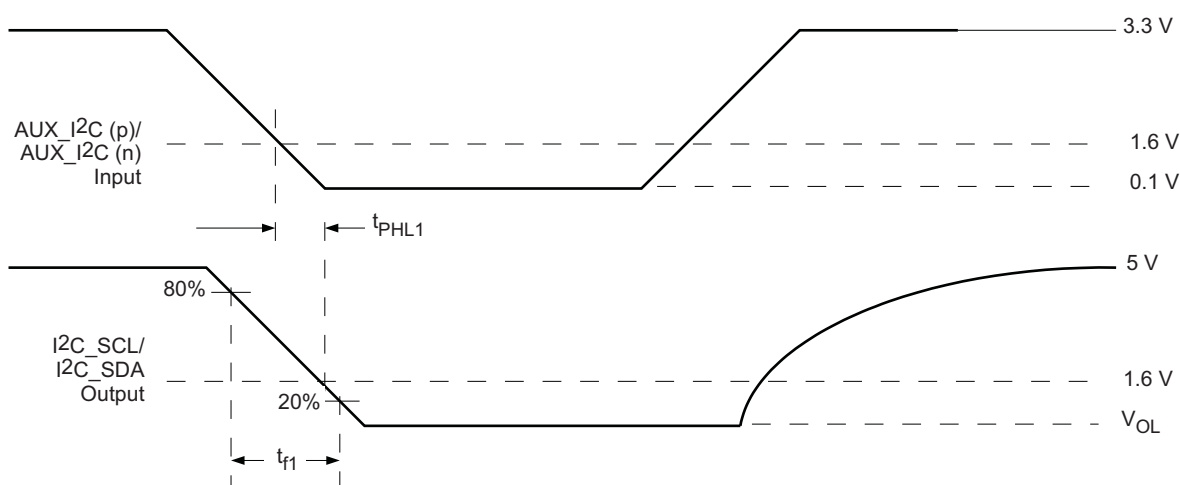
**Figure 14. Source Side Test Circuit (AUX\_I<sup>2</sup>C)**



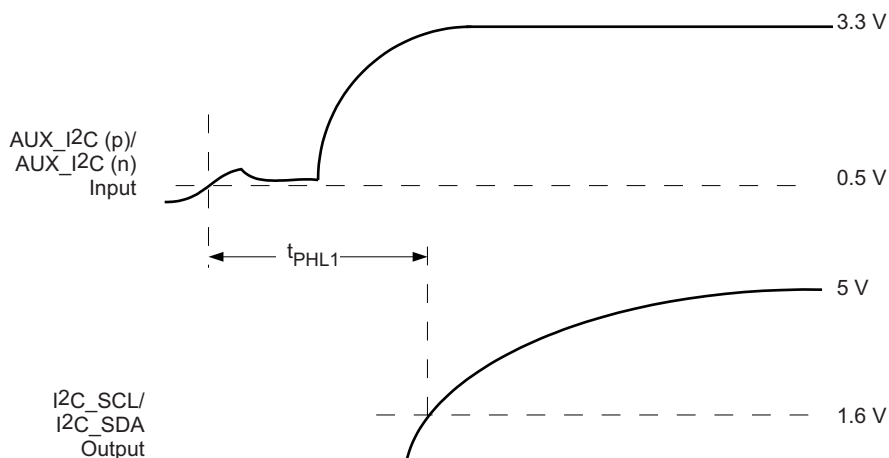
**Figure 15. Sink Side Test Circuit (SCL, SDA)**



**Figure 16. Source Side Output AC Measurements**



**Figure 17. Sink Side Output AC Measurements**



**Figure 18. Sink Side Output AC Measurements Continued**

## TMDS MAIN LINK PINS

The TMDS port of the SN75DP122A is designed to be compliant with the Digital Video Interface (DVI) 1.0 and High Definition Multimedia Interface (HDMI) 1.3 specifications. The differential output voltage swing can be fine tuned with the VSadj resistor.

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V <sub>OH</sub>	Single-ended HIGH level output voltage	AVCC –10	AVCC+10		mV
V <sub>OL</sub>	Single-ended LOW level output voltage	AVCC –600	AVCC –400		mV
V <sub>SWING</sub>	Single-ended output voltage swing	400		600	mV
V <sub>OC(SS)</sub>	Change in steady-state common-mode output voltage between logic states	–5		5	mV
V <sub>OD(PP)</sub>	Peak-to-Peak output differential voltage	800		1200	mV
V <sub>(O)SBY</sub>	Single-ended standby output voltage	AVCC –10	AVCC+10		mV
I <sub>(O)OFF</sub>	Single-ended power down output current	–10		10	μA
I <sub>OS</sub>	Short circuit output current	–15		15	mA

## SWITCHING CHARACTERISTICS

over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time	250	480	600	ps
t <sub>PHL</sub>	Propagation delay time	250	400	800	ps
t <sub>R</sub>	Rise time	60	90	140	ps
t <sub>F</sub>	Fall time	60	90	140	ps
t <sub>SK(P)</sub>	Pulse skew		8	15	ps
t <sub>SK(D)</sub>	Intra-pair skew		20	40	ps
t <sub>SK(O)</sub>	Inter-pair skew		20	65	ps
t <sub>JTD(PP)</sub>	Peak-to-peak output residual data jitter	AVCC = 3.3 V, R <sub>T</sub> = 50 Ω, dR = 2.5 Gbps	20	50	ps
t <sub>JTC(PP)</sub>	Peak-to-peak output residual clock jitter	AVCC = 3.3 V, R <sub>T</sub> = 50 Ω, f = 250 MHz	10	30	ps

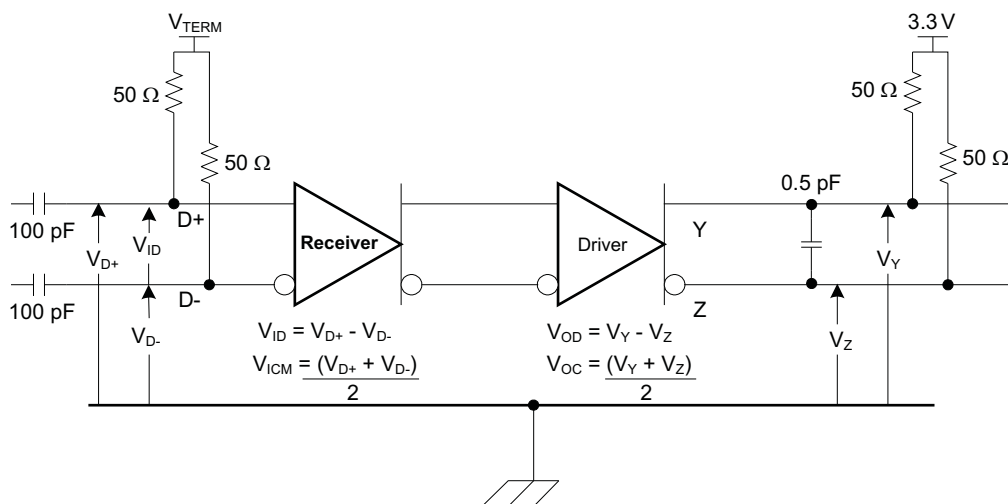


Figure 19. TMD5 Main Link Test Circuit

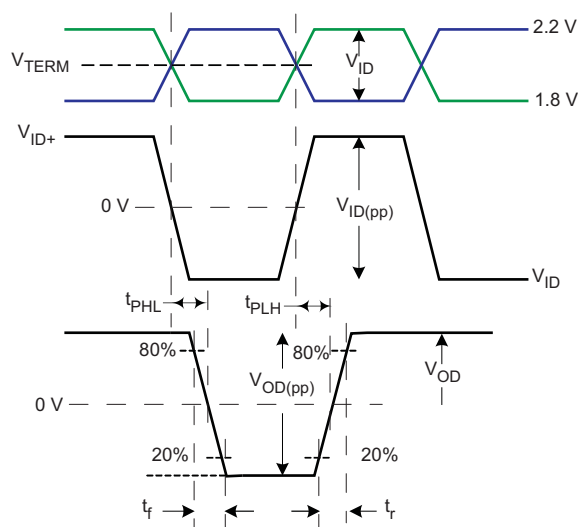


Figure 20. TMD5 Main Link Timing Measurements

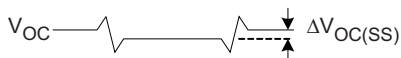
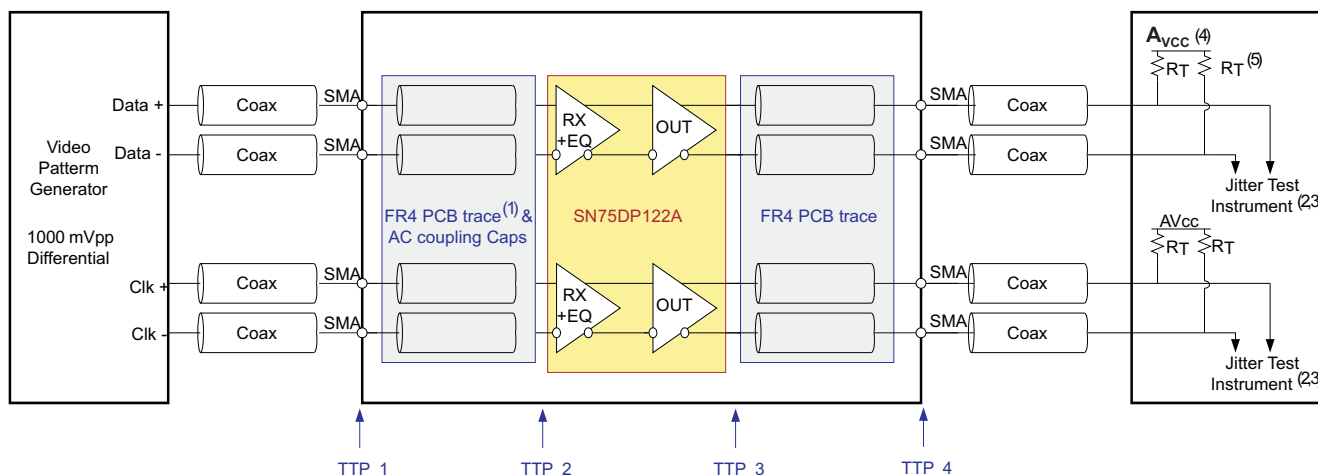


Figure 21. TMD5 Main Link Common Mode Measurements



- (1) The FR4 trace between TTP1 and TTP2 is designed to emulate 8" of FR4, a connector, and another 8" of FR4.
- (2) All Jitter is measured at a BER of  $10^{-12}$
- (3) Residual jitter reflects the total jitter measured at TTP4 minus the jitter measured at TTP1
- (4)  $AVCC = 3.3\text{ V}$
- (5)  $R_T = 50\ \Omega$

Figure 22. TMD5 Jitter Measurements

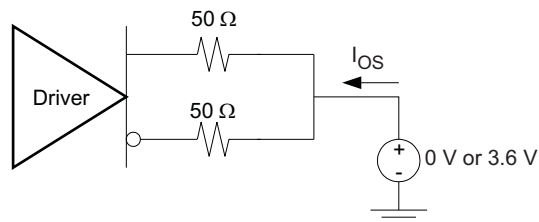
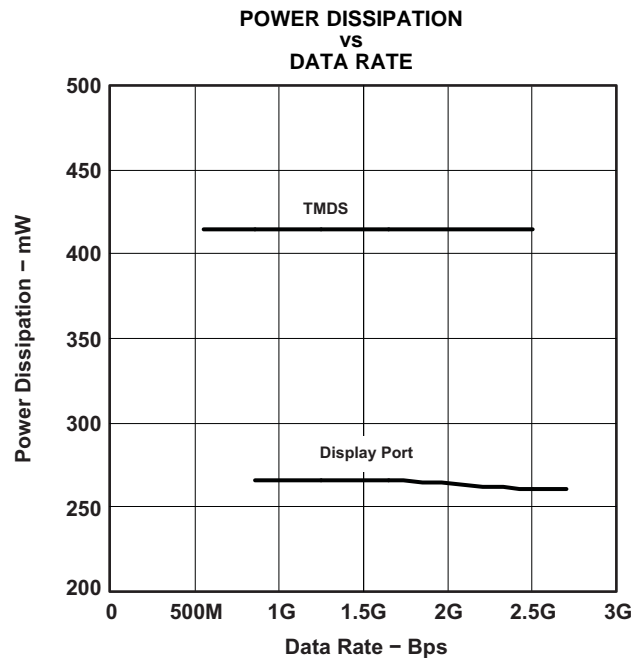
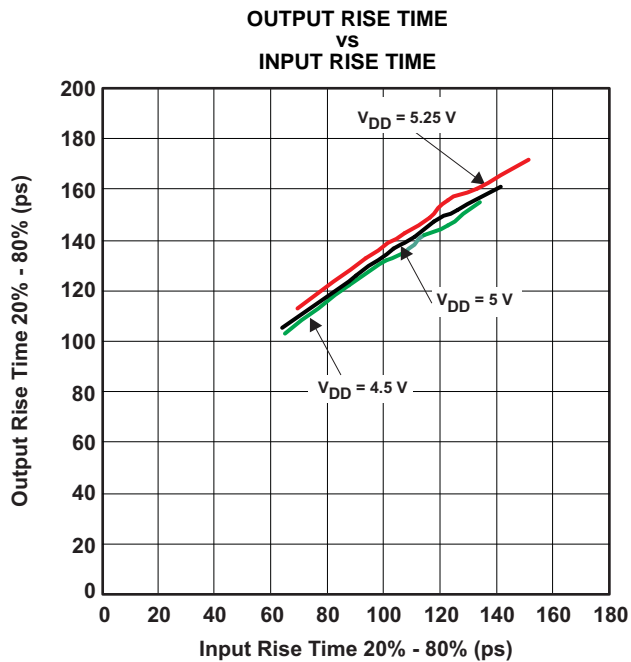
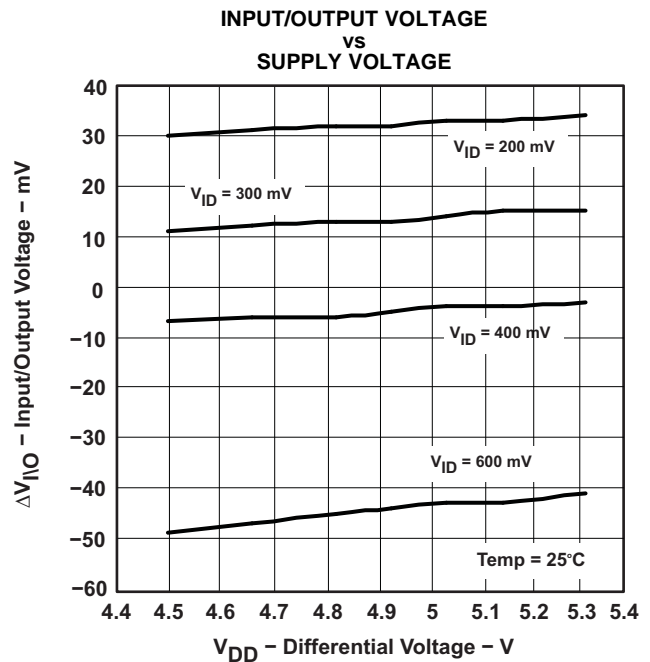
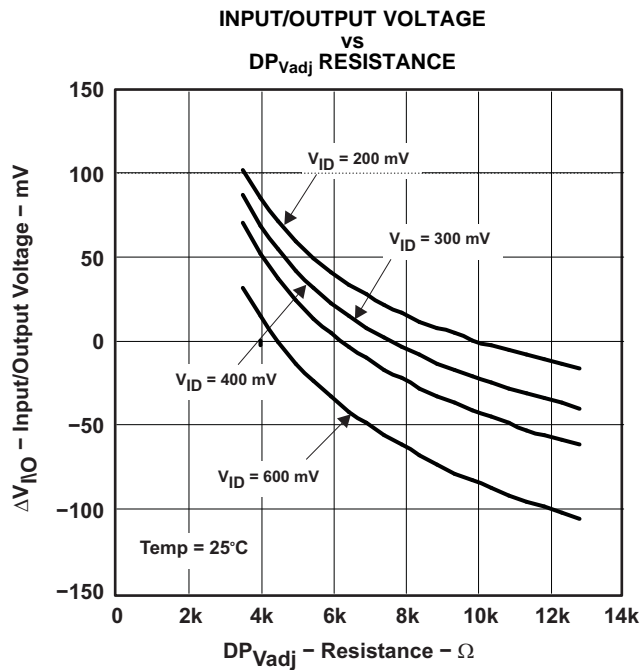


Figure 23. TMD5 Main Link Short Circuit Output Circuit

## TYPICAL CHARACTERISTICS



- (1) TMSD power dissipation in this graph includes 132 mW of power supplied by the AVCC termination.

## TYPICAL CHARACTERISTICS (continued)

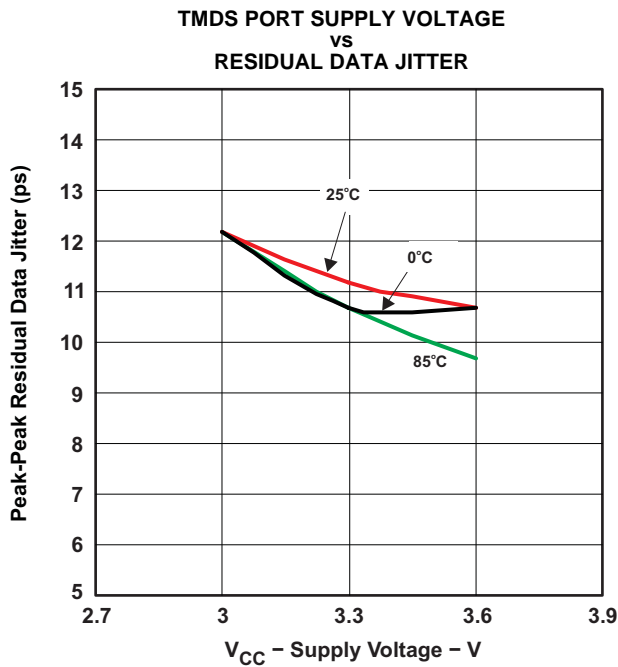


Figure 28.

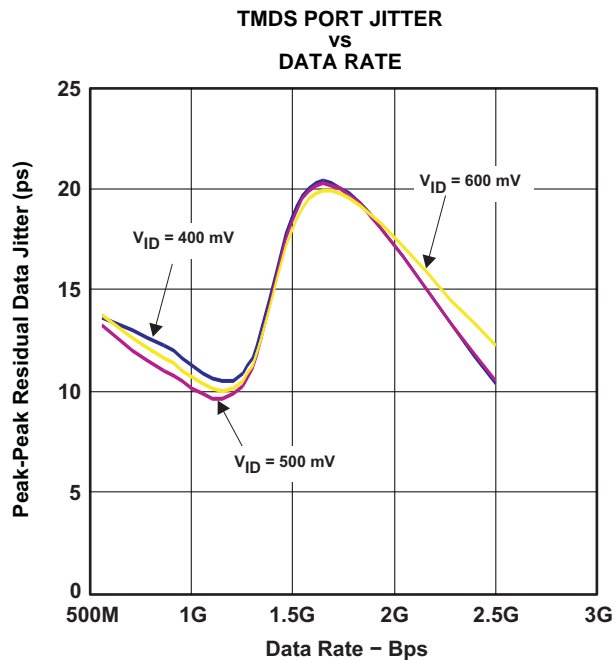


Figure 29.

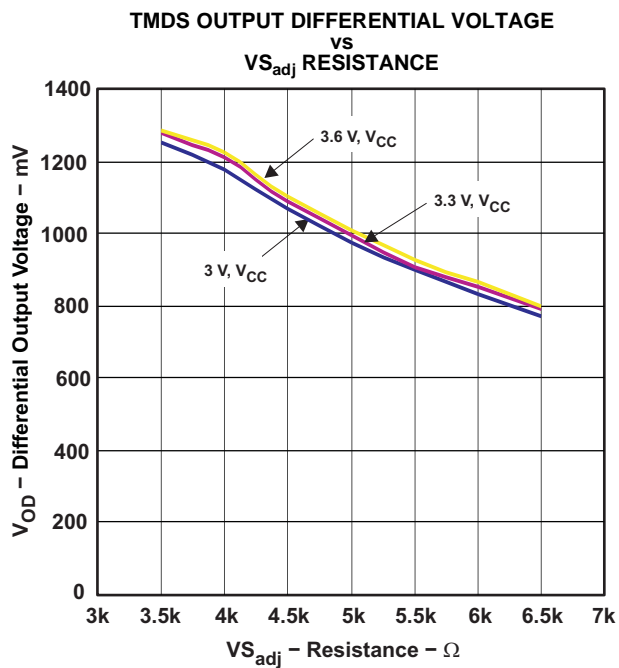


Figure 30.

## APPLICATION INFORMATION

### SWITCHING LOGIC

The Switching logic of the SN75DP122A is tied to the state of the HPD pins as well as the LP and priority pins. When both HPD\_A and HPD\_B input pins are LOW, the SN75DP122A enters the low power state. In this state the outputs are high impedance. 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.

In order to ease the transitioning from one output port to the other output port the SN75DP122A forces the HPD output pin LOW for an extended duration. This forced Low is designed to mimic an unplug event for the transmitting device. This should allow for a smooth transition from one port to another. This forced LOW timer can be bypassed by pulsing the LP pin LOW for a short duration and then returning to HIGH. When the LP pin is driven LOW the device enters a low power state and the internal logic block is reset.

### I<sup>2</sup>C INTERFACE NOTES

The I<sup>2</sup>C interface can be used to access the internal memory of the SN75DP122A. I<sup>2</sup>C is a two-wire serial interface developed by Philips Semiconductor (see I<sup>2</sup>C-Bus Specification, Version 2.1, January 2000). The bus consists of a data line (SDA) and a clock line (SCL) with pull-up structures. When the bus is *idle*, both SDA and SCL lines are pulled high. All the I<sup>2</sup>C compatible devices connect to the I<sup>2</sup>C bus through open drain I/O pins, SDA and SCL. A *master* device, usually a microcontroller or a digital signal processor, controls the bus. The master is responsible for generating the SCL signal and device addresses. The master also generates specific conditions that indicate the START and STOP of data transfer. A *slave* device receives and/or transmits data on the bus under control of the master device. The SN75DP122A works as a slave and supports the standard mode transfer (100 kbps) and fast mode transfer (400 kbps) as defined in the I<sup>2</sup>C-Bus Specification.

The basic I<sup>2</sup>C start and stop access cycles are shown in [Figure 31](#).

The basic access cycle consists of the following:

- A start condition
- A slave address cycle
- Any number of data cycles
- A stop condition

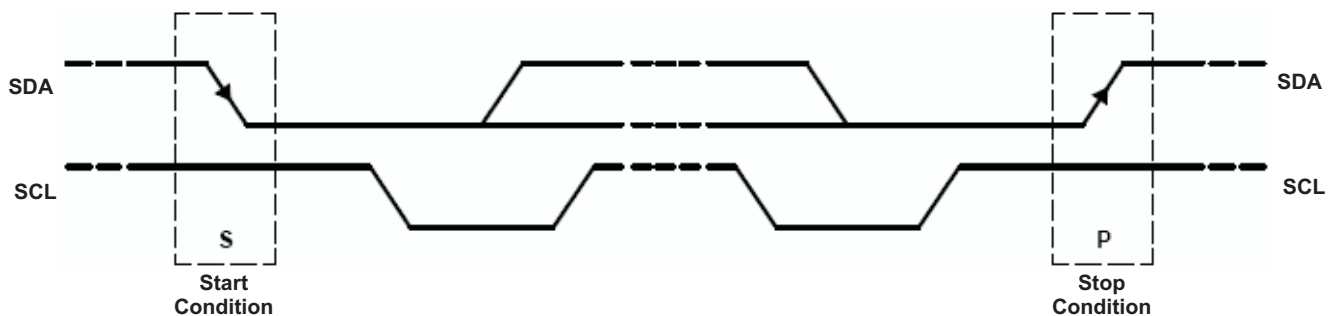


Figure 31. I<sup>2</sup>C Start and Stop Conditions

### GENERAL I<sup>2</sup>C PROTOCOL

- The *master* initiates data transfer by generating a *start condition*. The *start condition* is when a high-to-low transition occurs on the SDA line while SCL is high, as shown in [Figure 31](#). All I<sup>2</sup>C-compatible devices should recognize a *start condition*.
- The master then generates the SCL pulses and transmits the 7-bit address and the *read/write direction bit* R/W on the SDA line. During all transmissions, the master ensures that data is *valid*. A *valid data* condition requires the SDA line to be stable during the entire high period of the clock pulse (see [Figure 32](#)). All devices recognize the address sent by the master and compare it to their internal fixed addresses. Only the slave device with a matching address generates an *acknowledge* (see [Figure 33](#)) by pulling the SDA line low during the entire high period of the ninth SCL cycle. On detecting this acknowledge, the master knows that a

communication link with a slave has been established.

- The master generates further SCL cycles to either *transmit* data to the slave (R/W bit 0) or *receive* data from the slave (R/W bit 1). In either case, the *receiver* needs to acknowledge the data sent by the *transmitter*. So an acknowledge signal can either be generated by the master or by the slave, depending on which one is the receiver. The 9-bit valid data sequences consisting of 8-bit data and 1-bit acknowledge can continue as long as necessary (see Figure 34).
- To signal the end of the data transfer, the master generates a *stop condition* by pulling the SDA line from low to high while the SCL line is high (see Figure 31). This releases the bus and stops the communication link with the addressed slave. All I<sup>2</sup>C compatible devices must recognize the *stop condition*. Upon the receipt of a stop condition, all devices know that the bus is released, and they wait for a *start condition* followed by a matching address.

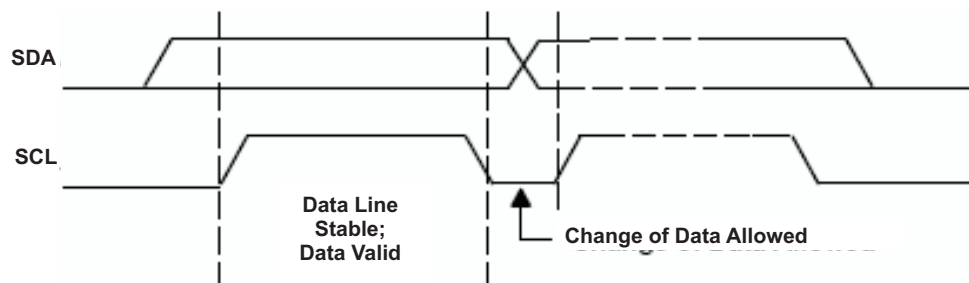


Figure 32. I<sup>2</sup>C Bit Transfer

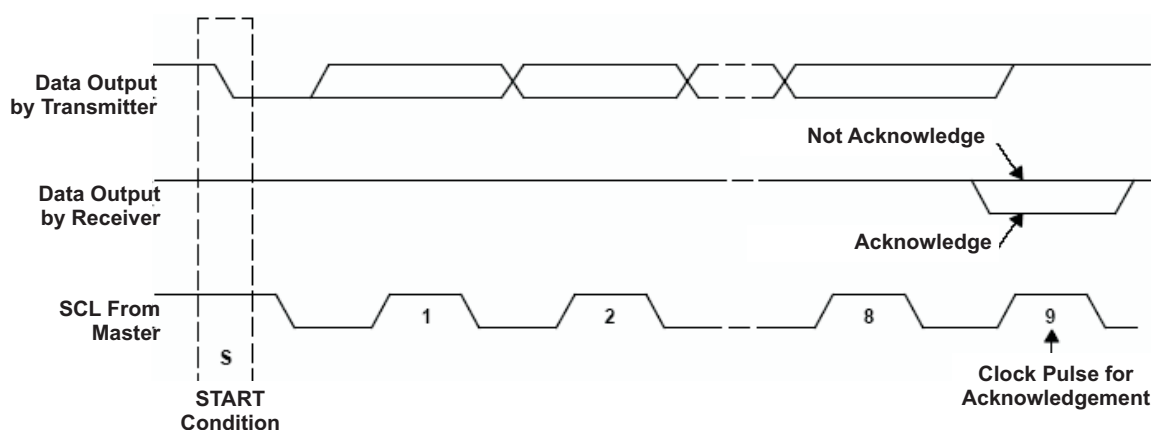


Figure 33. I<sup>2</sup>C Acknowledge

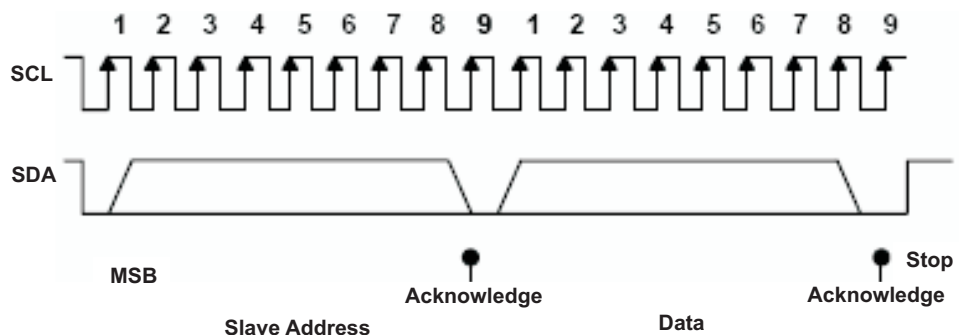


Figure 34. I<sup>2</sup>C Address and Data Cycles

During a read cycle, the slave receiver acknowledges the initial address byte if it decodes the address as its

address. Following this initial acknowledge by the slave, the master device becomes a receiver and acknowledges data bytes sent by the slave. When the master has received all of the requested data bytes from the slave, the not acknowledge (A) condition is initiated by the master by keeping the SDA signal high just before it asserts the stop (P) condition. This sequence terminates a read cycle as shown in [Figure 35](#) and [Figure 36](#). See **Example – Reading from the SN75DP122A** section for more information.

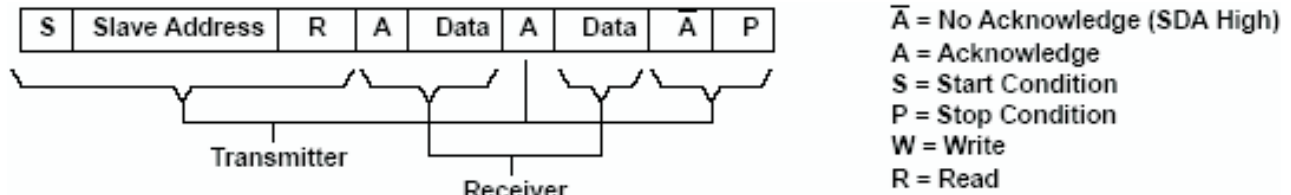
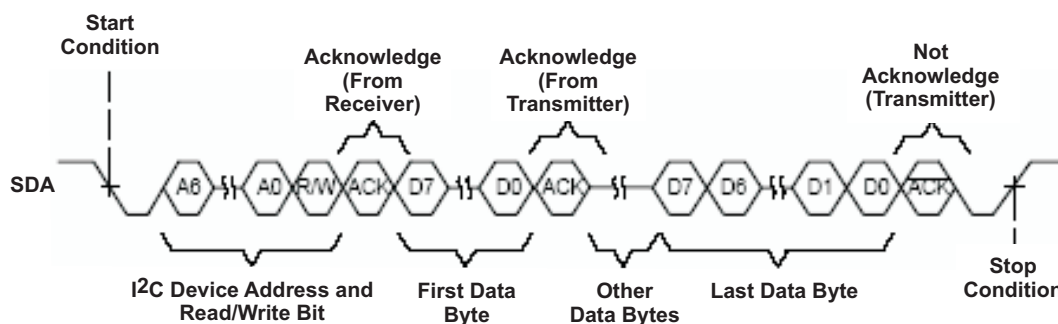
Figure 35. I<sup>2</sup>C Read Cycle

Figure 36. Multiple Byte Read Transfer

## Slave Address

Both SDA and SCL must be connected to a positive supply voltage via a pull-up resistor. These resistors should comply with the I<sup>2</sup>C specification that ranges from 2 kΩ to 19 kΩ. When the bus is free, both lines are high. The address byte is the first byte received following the START condition from the master device. The 7-bit address is factory preset to 1000000. [Table 2](#) lists the calls that the SN75DP122A responds to.

Table 2. SN75DP122A Slave Address

FIXED ADDRESS							READ/WRITE BIT
Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (R/W)
1	0	0	0	0	0	0	1

## Sink Port Selection Register and Source Plug-In Status Register Description (Sub-Address)

The SN75DP122A operates using a multiple byte transfer protocol similar to [Figure 36](#). The internal memory of the SN75DP122A contains the phrase *DP-HDMI ADAPTOR<EOT>* converted to ASCII characters. The internal memory address registers and the value of each can be found in [Table 3](#).

During a read cycle, the SN75DP122A sends the data in its selected sub-address in a single transfer to the master device requesting the information. See the **Example – Reading from the SN75DP122A** section of this document for the proper procedure on reading from the SN75DP122A.

Table 3. SN75DP122A Sink Port and Source Plug-In Status Registers Selection

Address	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07	0x08	0x09	0x0A	0x0B	0x0C	0x0D	0x0E	0x0F	0x10
Data	44	50	2D	48	44	4D	49	20	41	44	41	50	54	4F	52	04	FF

## EXAMPLE – READING FROM THE SN75DP122A

The read operation consists of several steps. The I<sup>2</sup>C master begins the communication with the transmission of the start sequence followed by the slave address of the SN75DP122A. The SN75DP122A acknowledges its presence to the master and begin to transmit the contents of the memory registers. After each byte is transferred the SN75DP122A waits for either an acknowledge (ACK) or a not-acknowledge (NACK) from the master. If an ACK is received, the next byte of data is transmitted. If a NACK is received the data transmission sequence is expected to end and the master should send the stop command.

The SN75DP122A continues to send data as long as the master continues to acknowledge each byte transmission. If an ACK is received after the transmission of byte 0x0F, the SN75DP122A transmits byte 0x10 and continue to transmit byte 0x10 for all further ACK's until a NACK is received.

### SN75DP122A Read Phase:

<b>Step 1</b>	0							
I <sup>2</sup> C Start (Master)	S							
<b>Step 2</b>	7	6	5	4	3	2	1	0
I <sup>2</sup> C General Address (Master)	1	0	0	0	0	0	0	1
<b>Step 3</b>	9							
I <sup>2</sup> C Acknowledge (Slave)	A							
<b>Step 10</b>	7	6	5	4	3	2	1	0
I <sup>2</sup> C Read Data (Slave)	Data	Data	Data	Data	Data	Data	Data	Data

Where Data is determined by the logic values contained in the Sink port register

<b>Step 11</b>	9
I <sup>2</sup> C Not-Acknowledge (Master)	X

Where X is either an A (Acknowledge) or  $\bar{A}$  (Not-Acknowledge)

An A causes the pointer to increment and step 10 is repeated

An  $\bar{A}$  causes the slave to stop transmitting and proceed to step 12

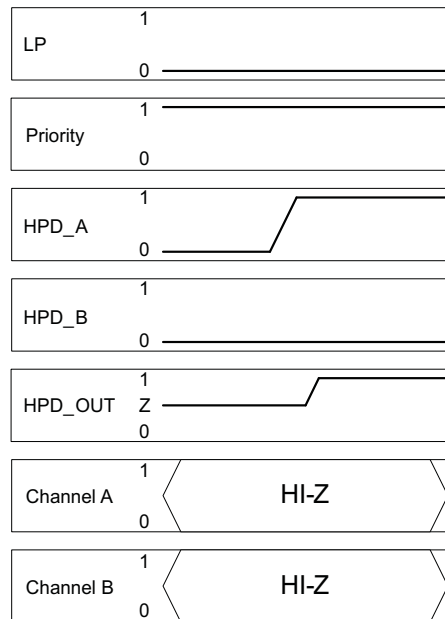
<b>Step 12</b>	0
I <sup>2</sup> C Stop (Master)	P

## SWITCHING LOGIC

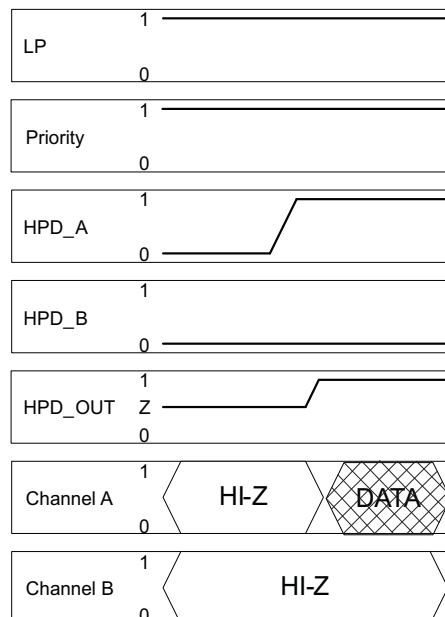
The switching logic of the SN75DP122A is tied to the state of the HPD input pins as well as the priority pin and low power pin. When both HPD\_A and HPD\_B input pins are LOW, the SN75DP122A enters the low power state. In this state the outputs are high impedance, and the device is shutdown to optimize 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 37](#)). The state of the Priority pin has no effect in this scenario as only one HPD input port is active.

**Figure 37.**

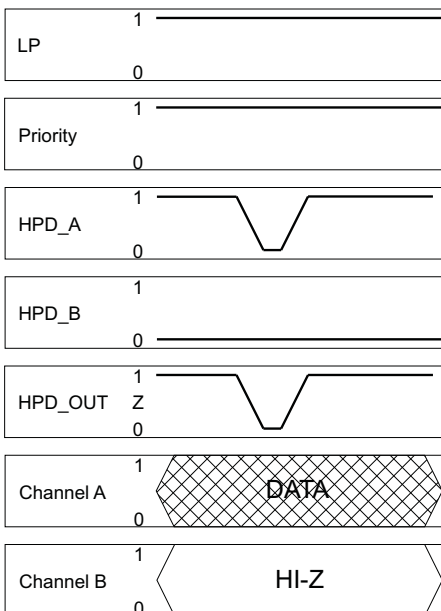
- Case two: In this case both HPD inputs are initially LOW and the low power pin is HIGH. In this initial state the device is in a low power mode. Once one of the HPD inputs goes to a HIGH state, the device comes out of the low power mode and enters active mode enabling the main link and auxiliary I/O. 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 38](#)). 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 38.**

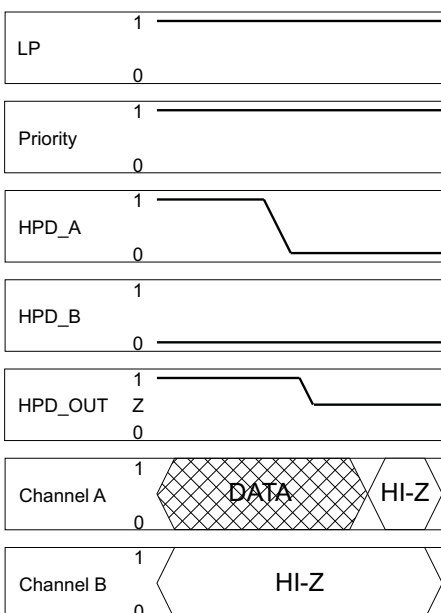
## 2. HPD Changes on the selected port. There are also two possible starting cases for this scenario:

- 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 39). The delay of this signal through the SN75DP122A 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 40). 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.



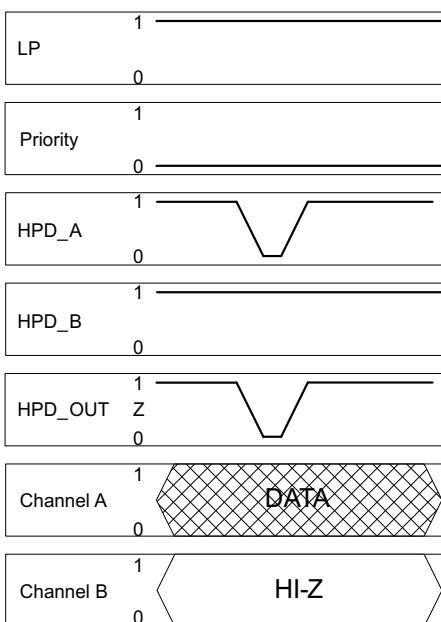
**Figure 39.**



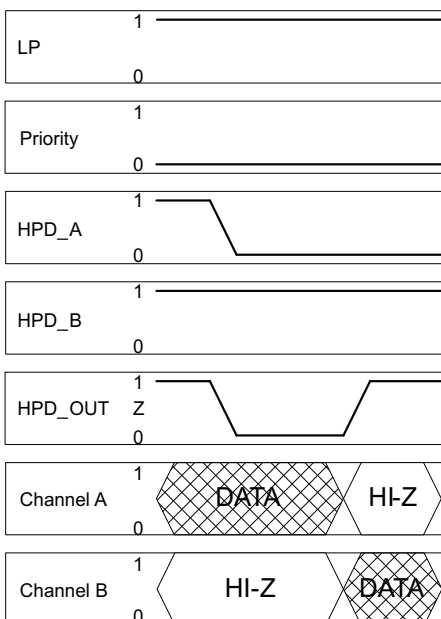
**Figure 40.**

- 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 41). 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 42). The case in

which the previously selected port with priority goes high again is covered in scenario 3.

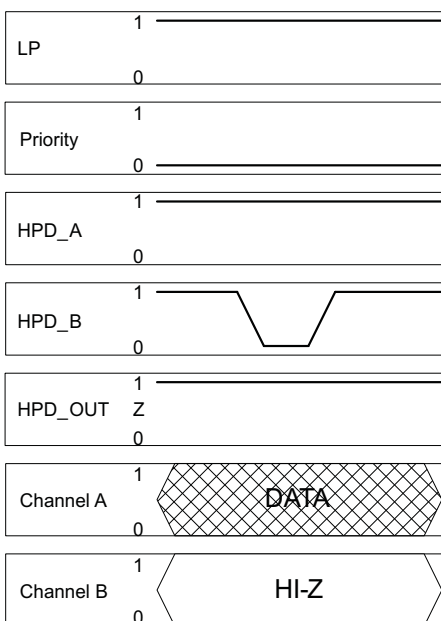


**Figure 41.**



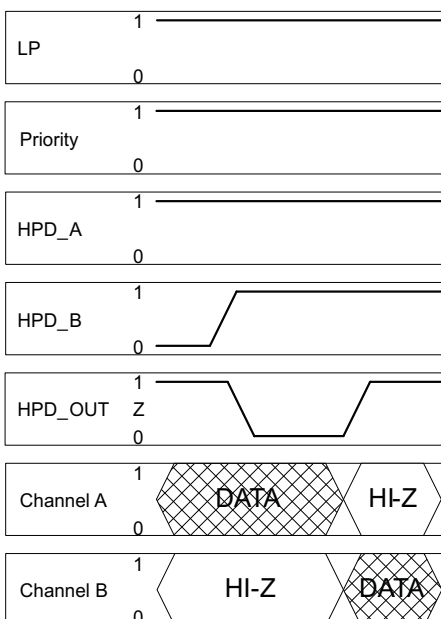
**Figure 42.**

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 does not have any effect on the switch whatsoever (see [Figure 43](#)).



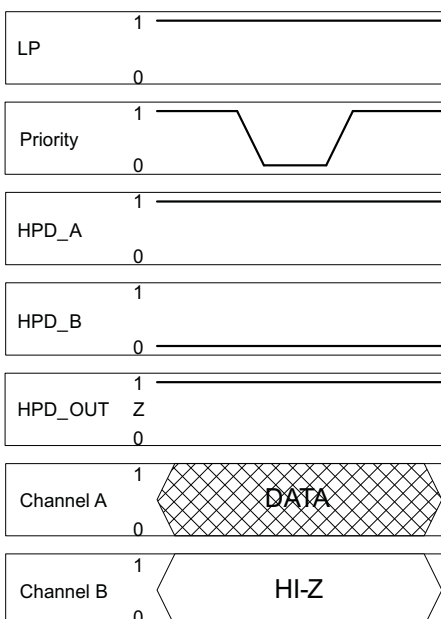
**Figure 43.**

- 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 44).

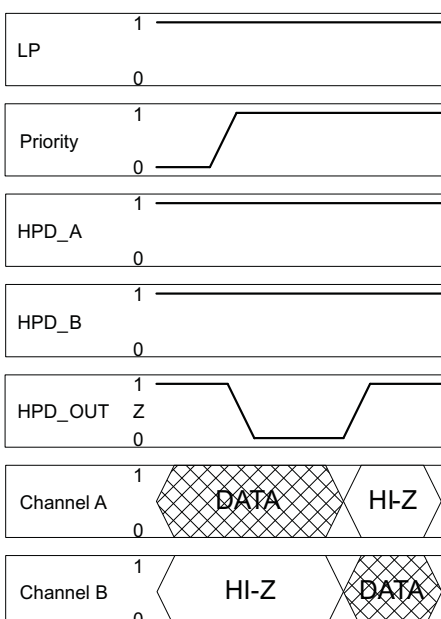


**Figure 44.**

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 45).

**Figure 45.**

- 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 46). 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 46.**

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN75DP122ARTQR</a>	Active	Production	QFN (RTQ)   56	2000   LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 85	DP122A
SN75DP122ARTQR.B	Active	Production	QFN (RTQ)   56	2000   LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 85	DP122A
<a href="#">SN75DP122ARTQT</a>	Active	Production	QFN (RTQ)   56	250   SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 85	DP122A
SN75DP122ARTQT.B	Active	Production	QFN (RTQ)   56	250   SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 85	DP122A

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

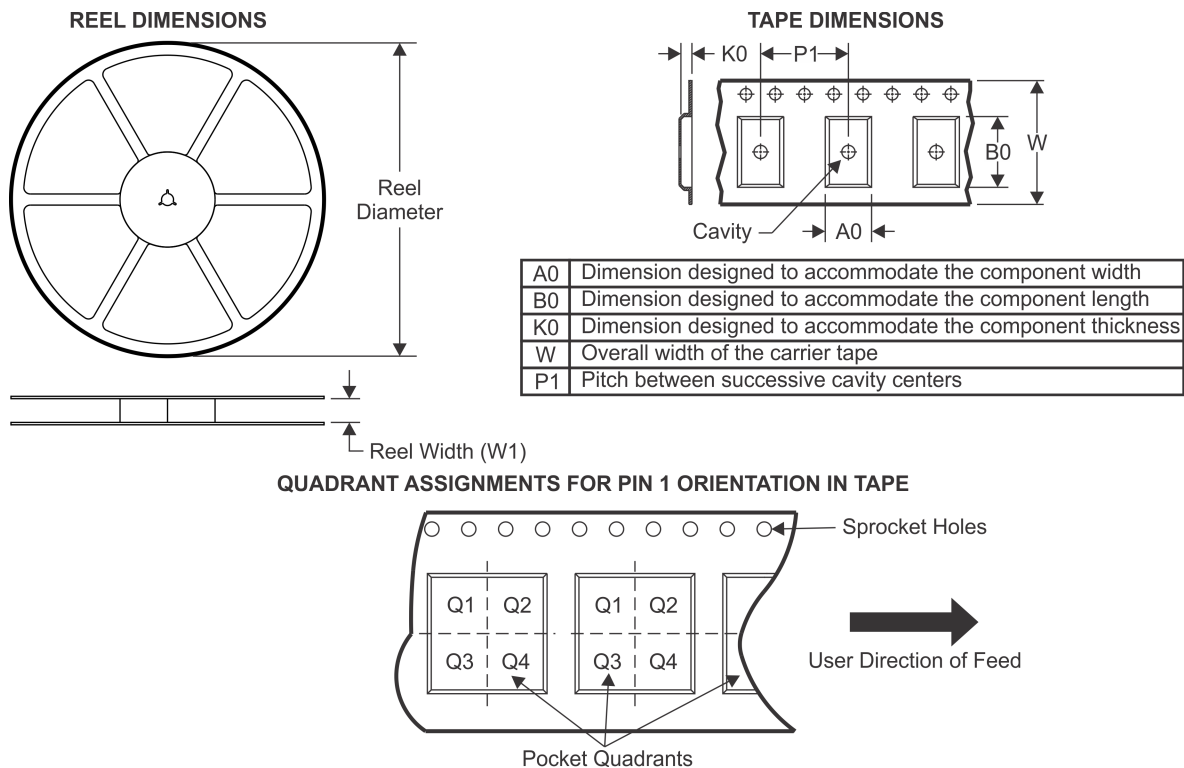
<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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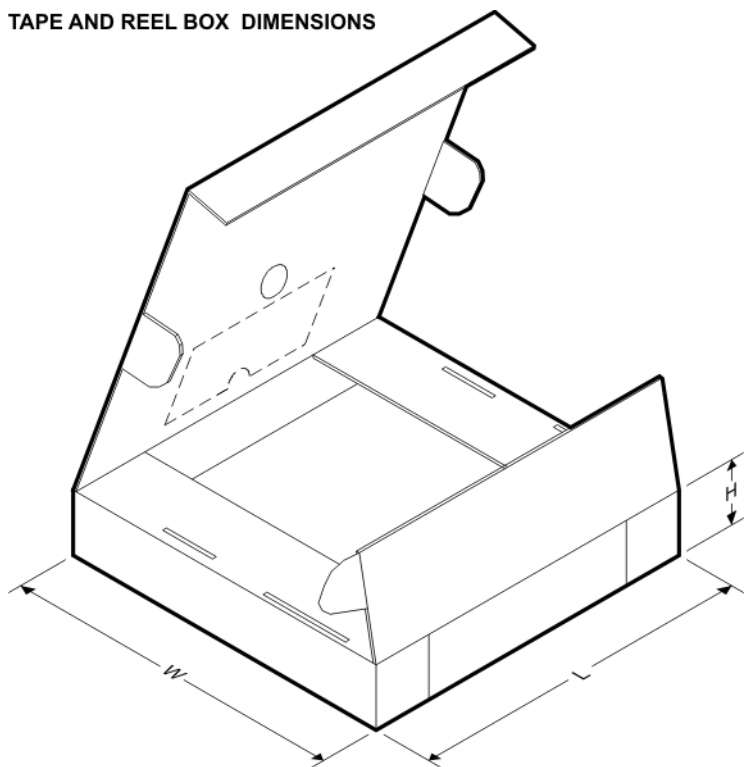
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**TAPE AND REEL INFORMATION**


\*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
SN75DP122ARTQR	QFN	RTQ	56	2000	330.0	16.4	8.3	8.3	1.1	12.0	16.0	Q2
SN75DP122ARTQT	QFN	RTQ	56	250	180.0	16.4	8.3	8.3	1.1	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)
SN75DP122ARTQR	QFN	RTQ	56	2000	367.0	367.0	38.0
SN75DP122ARTQT	QFN	RTQ	56	250	210.0	185.0	35.0

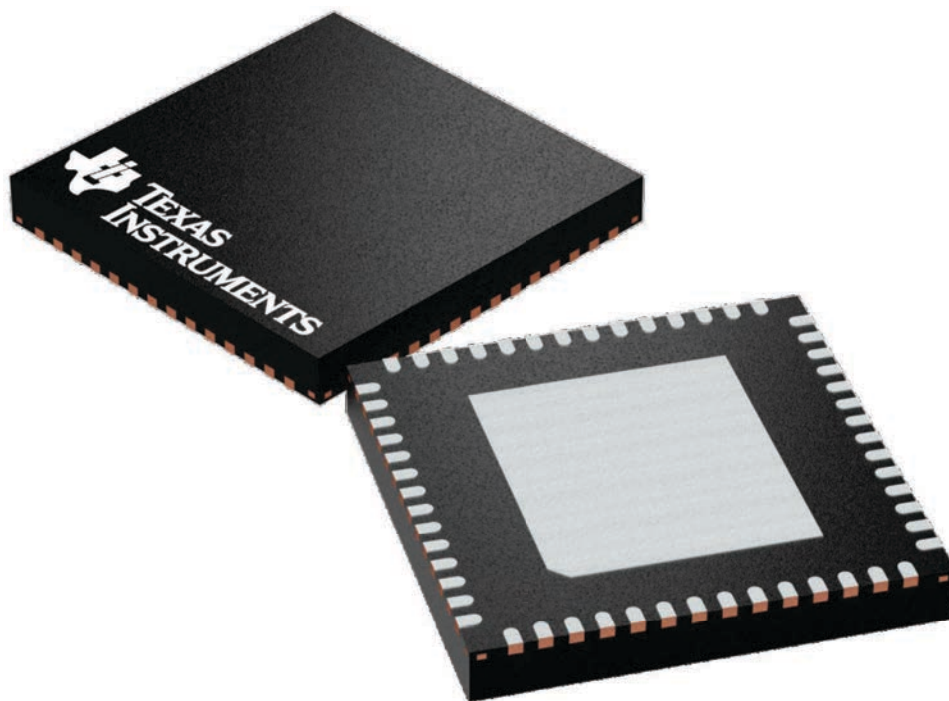
## GENERIC PACKAGE VIEW

**RTQ 56**

**VQFN - 1 mm max height**

8 x 8, 0.5 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD



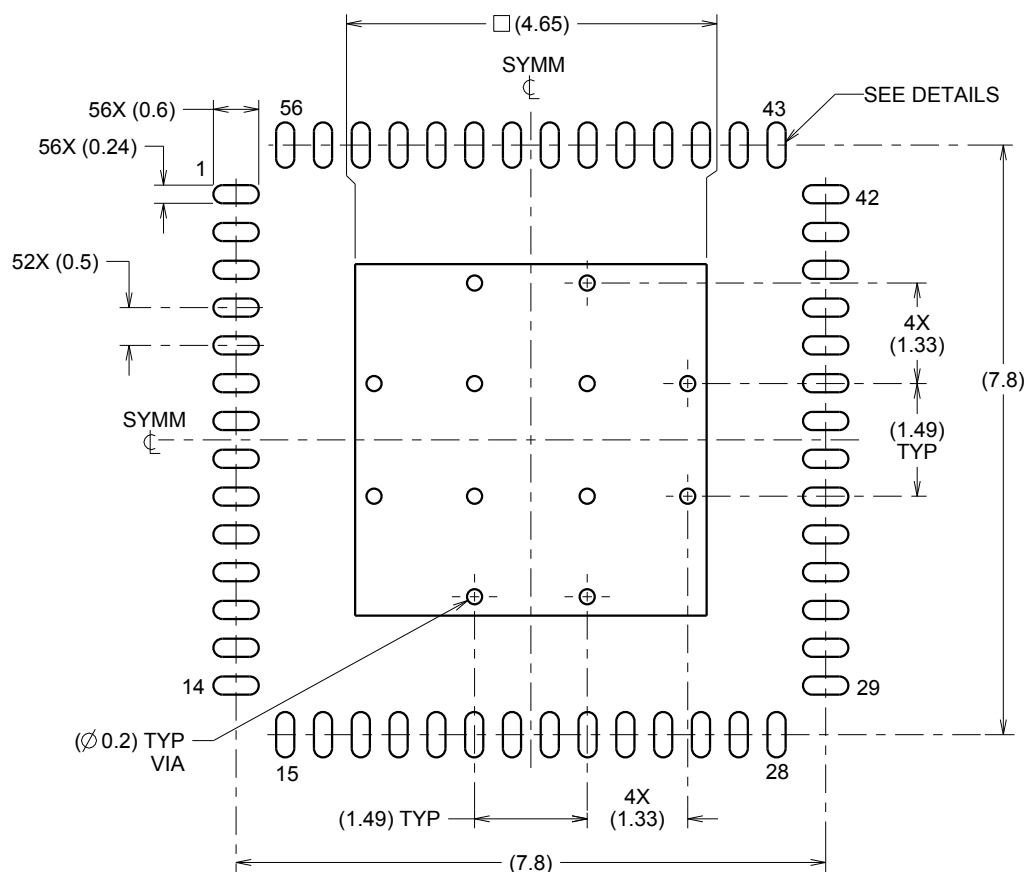
Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4224653/A

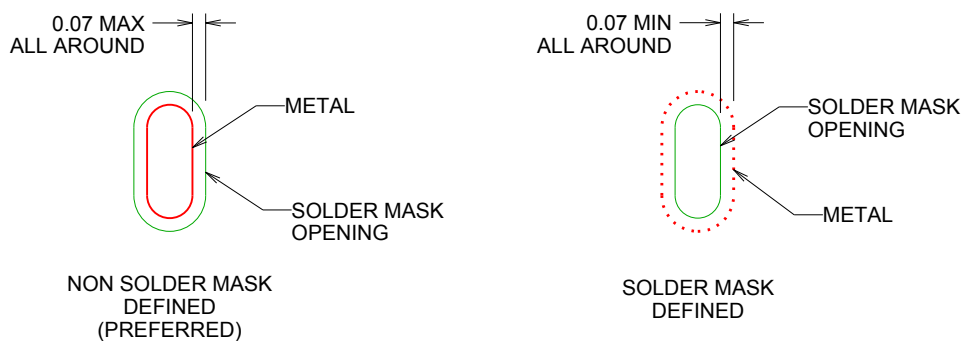
VQFN - 1 mm max height

[illegible]

TEXAS  
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LAND PATTERN EXAMPLE  
SCALE:10X



SOLDER MASK DETAILS

4218798/A 09/2013

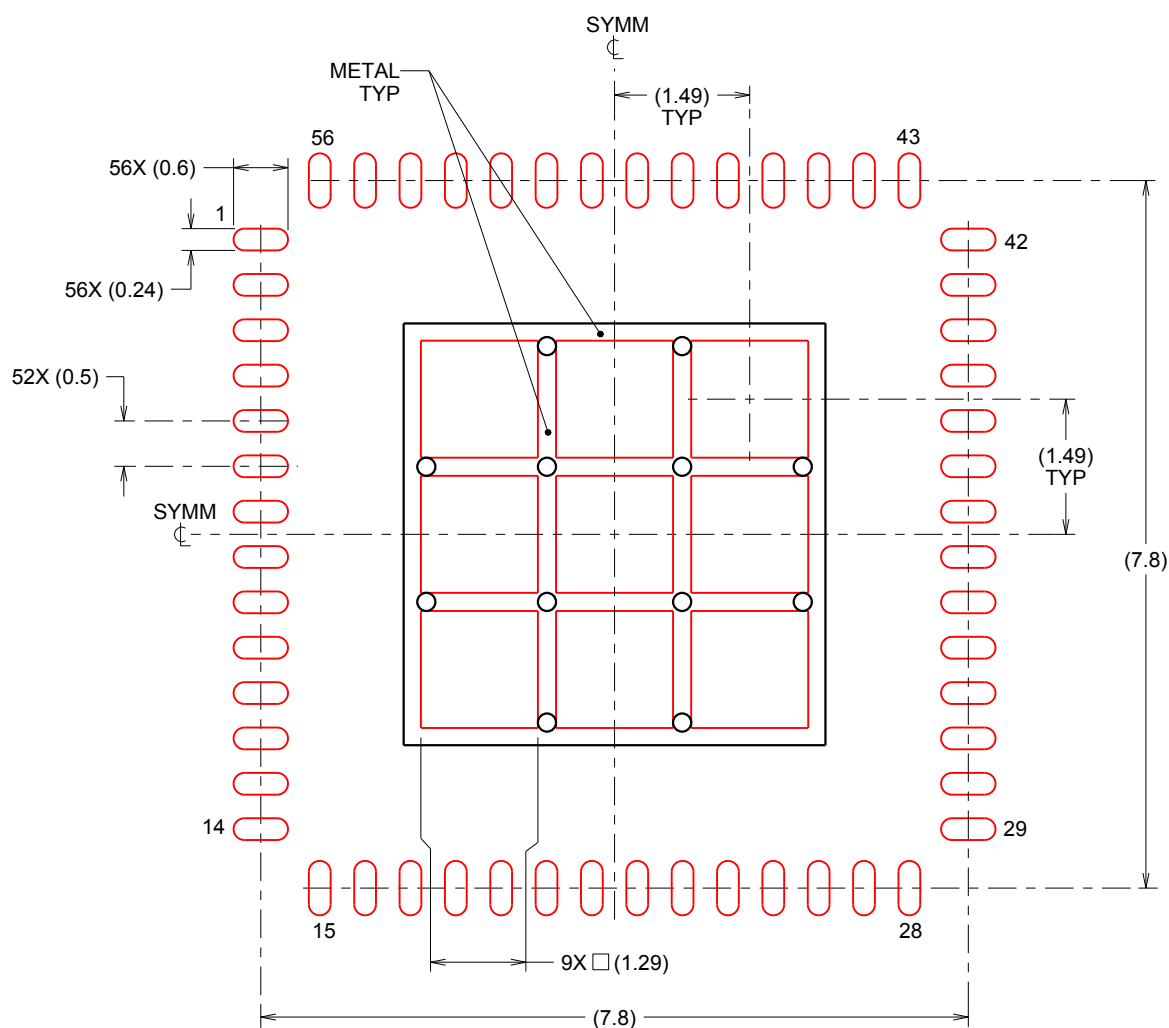
NOTES: (continued)

- This package is designed to be soldered to a thermal pad on the board. For more information, see QFN/SON PCB application report in literature No. SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).

RTQ0056A

VQFN - 1 mm max height

VQFN



**SOLDER PASTE EXAMPLE**  
 BASED ON 0.125 mm THICK STENCIL  
 EXPOSED PAD  
 69% PRINTED SOLDER COVERAGE BY AREA  
 SCALE:12X

4218798/A 09/2013

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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