STHDMI001A

3.3V, High Bandwith, 2-to-1 High Definition Multimedia Interface (HDMI) Switch with Single Enable

Features

- Compatible with HDMI v1.1 and DVI v1.0 digital interfaces
- Data rate per channel for UXGA: 1.65Gbps
- 165MHz speed operation supports all video formats up to 1080p and SXGA (1280x1024 at 75 Hz)
- Low R_{ON}: 5.5 Ω(typ)
- V_{CC} operating range: 3.0V to 3.6V
- Low current consumption: 20μA
- ESD Human Body Model HMB Voltage:
  - 4KV for HDMI connector inputs
  - 2KV for all other I/Os
- Channel ON Capacitance: 6pF (typ)
- Switching speed: 9ns
- Near-Zero Propagation Delay: 250ps
- Low crosstalk: -32dB at 825MHz
- Bit-to-Bit Skew: 200ps
- Very Low Ground Bounce in Flow Through Mode
- Data and control inputs provide an undershoot clamp diode
- Wide bandwidth minimizes skew and jitter
- Hot insertion capable
- Supports bi-directional operation
- Available in the TSSOP48 package
- −40°C to 85°C operating temperature range

TSSOP48

Description

The STHDMI001A is a differential Single Pole Double Throw (SPDT) 2-to-1, low R_{ON}, bidirectional HDMI switch. It is designed to support HDMI/DVI television systems that produce superior high-definition image quality. The differential signal from the 2 HDMI ports is multiplexed through the switch to form a single output HDMI channel going to the HDMI receiver, while the deselected output goes to the high-Z (high impedance) state. It is designed for very low cross-talk, low bit-to-bit skew, high channel-to-channel noise isolation, and low I/O capacitance. This switch offers very little high-speed signal attenuation at the outputs, thus preserving the signal integrity necessary to pass stringent interference requirements. STHDMI001A provides the ability to switch a single source output to various display devices or switch video display devices between multiple sources. It reduces the overall BOM costs by eliminating the need for more costly multi input output controllers

Applications

- DVD Players
- Front projectors
- LCD TVs and Monitors
- Notebook PCs
- PDPs

Order Codes

Part Number	Temperature Range	Package	Comments
STHDMI001A	−65°C to +150°C	TSSOP48	STHDMI001ATTR

January 2006

Rev.2

1/17

Contents

1   Summary Description

1.1   Functional Description

The STHDMI001A routes physical layer signals for high bandwidth digital video and is compatible with low voltage differential signaling standards like Transition Minimized Differential Signaling (TMDS). The device multiplexes differential outputs from a video source to one of the two corresponding outputs, then to a common display. The low ON resistance (R_{ON}) and low I/O capacitance of the STHDMI001A result in a very small propagation delay. The device integrates SPDT-type switches for 3 differential data TMDS channels and 1 differential clock channel.
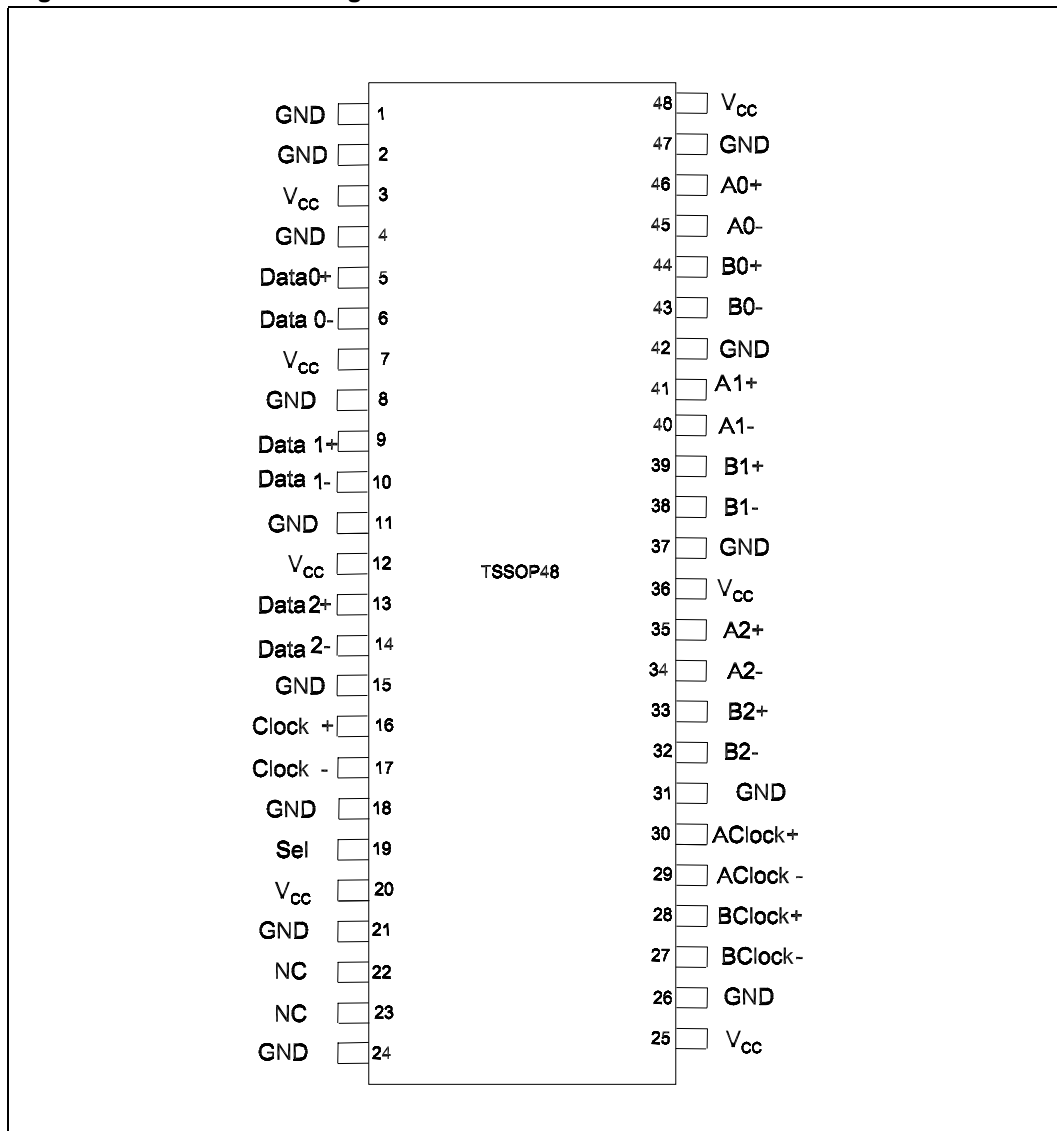
Figure 1.   Connections Diagram

Table 1.   Pin Description

Pin Number	Pin Name	Type	Function
1	GND	Power	Ground
2	GND	Power	Ground
3	V_{CC}	Power	Supply Voltage (3.3V ± 10%)
4	GND	Power	Ground
5	Data0+	Output	TMDS Data0+ Output
6	Data0–	Output	TMDS Data0–– Output
7	V_{CC}	Power	Supply Voltage (3.3V ± 10%)
8	GND	Power	Ground
9	Data1+	Output	TMDS Data1+ Output
10	Data1–	Output	TMDS Data1– Output
11	GND	Power	Ground
12	V_{CC}	Power	Supply Voltage (3.3V ± 10%)
13	Data2+	Output	TMDS Data2+ Output
14	Data2–	Output	TMDS Data2– Output
15	GND	Power	Ground
16	Clock+	Output	TMDS Clock+ Output
17	Clock–	Output	TMDS Clock– Output
18	GND	Power	Ground
19	SEL	Input	Selector Control input to select port A or port B
20	V_{CC}	Power	Supply Voltage (3.3V ± 10%)
21	GND	Power	Ground
22, 23	NC		Not Connected
24	GND	Power	Ground
25	V_{CC}	Power	Supply Voltage (3.3V ± 10%)
26	GND	Power	Ground
27	BClock–	Input	TMDS Clock– for port B
28	BClock+	Input	TMDS Clock+ for port B
29	AClock–	Input	TMDS Clock– for port A
30	AClock+	Input	TMDS Clock+ for port A
31	GND	Power	Ground
32	B2–	Input	TMDS Data2– for port B
33	B2+	Input	TMDS Data2+ for port B
34	A2–	Input	TMDS Data2– for port A
35	A2+	Input	TMDS Data2+ for port A
36	V_{CC}	Power	Supply Voltage (3.3V ± 10%)
37	GND	Power	Ground
38	B1–	Input	TMDS Data1– for port B
39	B1+	Input	TMDS Data1+ for port B
40	A1–	Input	TMDS Data1– for port A
41	A1+	Input	TMDS Data1+ for port A
42	GND	Power	Ground
43	B0–	Input	TMDS Data0– for port B
44	B0+	Input	TMDS Data0+ for port B
45	A0–	Input	TMDS Data0– for port A
46	A0+	Input	TMDS Data0+ for port A
47	GND	Power	Ground
48	V_{CC}	Power	Supply Voltage (3.3V ± 10%)

Figure 2.   2-to-1 HDMI Switch Functional Diagram
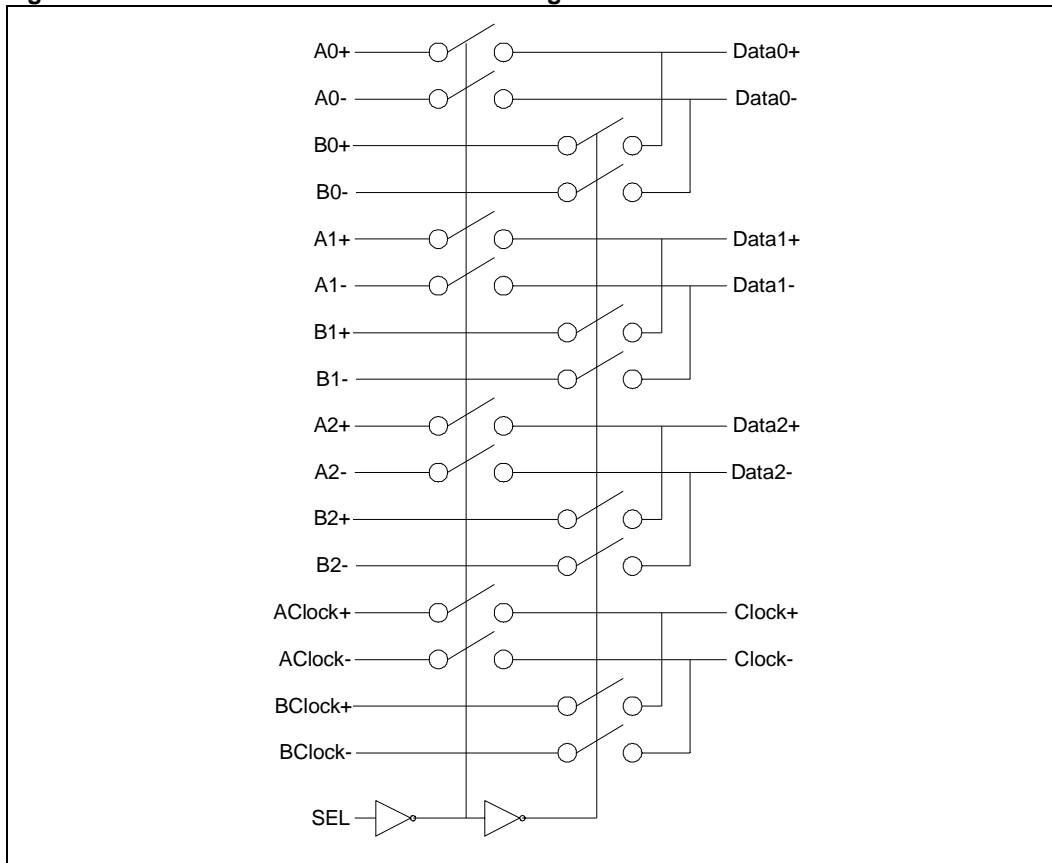
1.2   Function Table STHDMI001A

Table 2.   STHDMI001A Functions

Selection	Function
L	TMDS Data and Clock for Port A
H	TMDS Data and Clock for Port B

2   Maximum Rating

Stressing the device above the rating listed in the "Absolute Maximum Ratings" table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 3.   Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage to Ground	−0.5 to + 4.0	V
V_S	DC Input Voltage	−0.5 to + 4.0	V
V_{IC}	DC Control Input Voltage	−0.5 to + 4.0	V
I_O	DC Output Voltage	120	mA
T_{STG}	Storage Temperature	−65 to 150	°C
T_L	Lead Temperature (10sec)	300	°C
V_{ESD}	Electrostatic Discharge Voltage on HDMI Connector Pins 1	150	mJ

Note: *Absolute maximum ratings are those values above which damage to the device may occur. Functional operation under these conditions is not implied. All voltages are referenced to GND.*

In accordance with the IEC61000-4-2, Level 4 standards.

Table 4.   Thermal data

Symbol	Description	Value	Unit
R_{thJA}	Thermal Resistance Junction-ambient	59	°C/W

3   DC and AC Parameters

Table 5.   Electrical Characteristics

Symbol	Parameter	Test Conditions[1]	Min.	Typ.	Max.	Unit
V_{IH}	HIGH Level Input Voltage	High Level Guaranteed	2.0			V
V_{IL}	LOW Level Input Voltage	Low Level Guaranteed	−0.5		0.8	V
V_{IK}	Clamp Diode Voltage	V_{CC} = 3.6V, I_{IN} = −18mA		−0.8	−1.2	V
I_{IH}	Input High Current	V_{CC} = 3.6V, I_{IN} = V_{CC}			±5	µA
I_{IL}	Input Low Current	V_{CC} = 3.6V, I_{IN} = GND			±5	µA
I_{OFF}	Power Down Leakage Current	V_{CC} = 0V; Data0+, Data0−, Data1+, Data1−, Data2+, Data2−, Clock+, Clock− = 0V; A0+ to AClock− and B0+ to BClock− = 3.6V			±5	µA
R_{ON}	Switch ON resistance (*Note 2*)	V_{CC} = 3.0V, V_{IN} = 1.5 to V_{CC} I_{IN} = −40mA		5.5	7.5	Ω
R_{FLAT}	ON resistance flatness (*Note 2,3*)	V_{CC} = 3.0V, V_{IN} = 1.5 to V_{CC} I_{IN} = −40mA		0.8		Ω
ΔR_{ON}	ON resistance match between channels ΔR_{ON} = R_{ONMAX} − R_{ONMIN} (*Note 3,4*)	V_{CC} = 3.0V, V_{IN} = 1.5 to V_{CC} I_{IN} = −40mA		0.5	1	Ω

Note: 1   *Valid for Ambient Operating Temperature: T_A = −40 to 85°C; V_{CC} = 3.3V ± 10% (except where noted).*

2   *Measured by voltage drop between channels at the indicated current through the switch. On-resistance is determined by the lower of the two voltages.*

3   *Flatness is defined as the difference between the R_{ONMAX} and the R_{ONMIN} of the on resistance over the specified range.*

4   *ΔR_{ON} measured at the same V_{CC}, temperature and voltage level.*

3.1 Capacitance

Table 6. Capacitance

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{IN}	Input Capacitance (*Note:*4)	$V_{IN} = 0V$		2	3	pF
C_{OFF}	Port x0 to Port x1, Switch Off (*Note:*4)	$V_{IN} = 0V$		4	6	pF
C_{ON}	Capacitance Switch on (x to x0 or x to x1) (*Note:*4)	$V_{IN} = 0V$		7.5	11	pF

Note: *4. x = Data0+, Data0–, Data1+, Data1–, Data2+, Data2–, Clock+, Clock–*

              X0 = A0+, A0–, A1+, A1–, A2+, A2–, AClock+, AClock–

              X1 = B0+, B0–, B1+, B1–, B2+, B2–, BClock+, BClock–

3.2 Power Supply

Table 7. Power Supply Characterics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CC}	Quiescent Power Supply Current	$V_{CC} = 3.6$ V, $V_{IN} = V_{CC}$ or GND		150	500	µA

Note: *Valid for Ambient Operating Temperature: $T_A = –40$ to 85°C; $V_{CC} = 3.3V \pm 10\%$ (except where noted).*

4 Dynamic Characteristics

Figure 3. Measurement Circuit
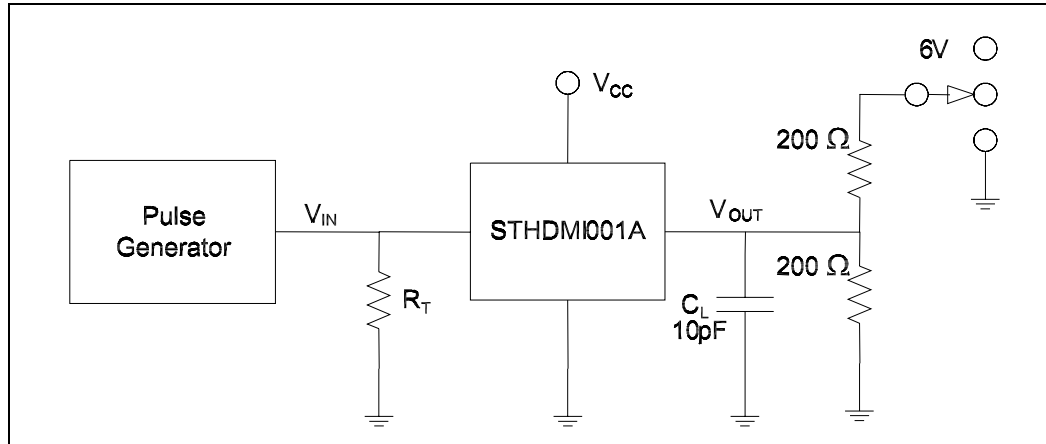
CL = Load Capacitance: includes jig and probe capacitance.

RT = Termination Resistance: should be equal to ZOUT of the Pulse Generator.

Table 8. Dynamic Characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
X_{TALK}	Non-adjacent channel Cross-talk	$R_L = 100\Omega$, f = 250MHz		-45		dB
		$R_L = 100\Omega$, f = 370MHz		-42		dB
		$R_L = 100\Omega$, f = 825MHz		-32		dB
O_{IRR}	Off Isolation	$R_L = 100\Omega$, f = 250MHz		-40		dB
		$R_L = 100\Omega$, f = 370MHz		-36		dB
		$R_L = 100\Omega$, f = 500MHz		-30		dB
		$R_L = 100\Omega$, f = 825MHz		-25		dB
D_R	Data rate per channel			1.65		Gbps

Note: *Valid for Ambient Operating Temperature: T_A = –40 to 85°C; V_{CC} = 3.3V ± 10% (except where noted).*

Table 9.   Dynamic Switching Characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{PLH}, t_{PHL}	Propagation Delay	V_{CC} = 3V to 3.6V		0.25		ns
t_{PZH}, t_{PZL}	Line Enable Time, SEL to x to x0 or x to x1, *Note:4*	V_{CC} = 3V to 3.6V	0.5	6.5	9	ns
t_{PHZ}, t_{PLZ}	Line Disable Time, SEL to x to x0 or x to x1, *Note:4*	V_{CC} = 3V to 3.6V	0.5	6.5	8.5	ns
$t_{SK(0)}$	Output skew between center port to any other port	V_{CC} = 3V to 3.6V		0.1	0.2	ns
$t_{SK(P)}$	Skew between opposite transition of the same output (t_{PHL} - t_{PLH})	V_{CC} = 3V to 3.6V		0.1	0.2	ns
t_{ON}	Propagation Delay	V_{CC} = 3V to 3.6V			50	ns
t_{OFF}	Propagation Delay	V_{CC} = 3V to 3.6V			30	ns

Note: *4. x = Data0+, Data0–, Data1+, Data1–, Data2+, Data2–, Clock+, Clock–.*

                   X0 = A0+, A0–, A1+, A1–, A2+, A2–, AClock+, AClock–

                   X1 = B0+, B0–, B1+, B1–, B2+, B2–, BClock+, BClock–

Note: *Valid for Ambient Operating Temperature: T_A = –40 to 85°C; V_{CC} = 3.3V ± 10% (except where noted).*

4.1   Timing Characteristics
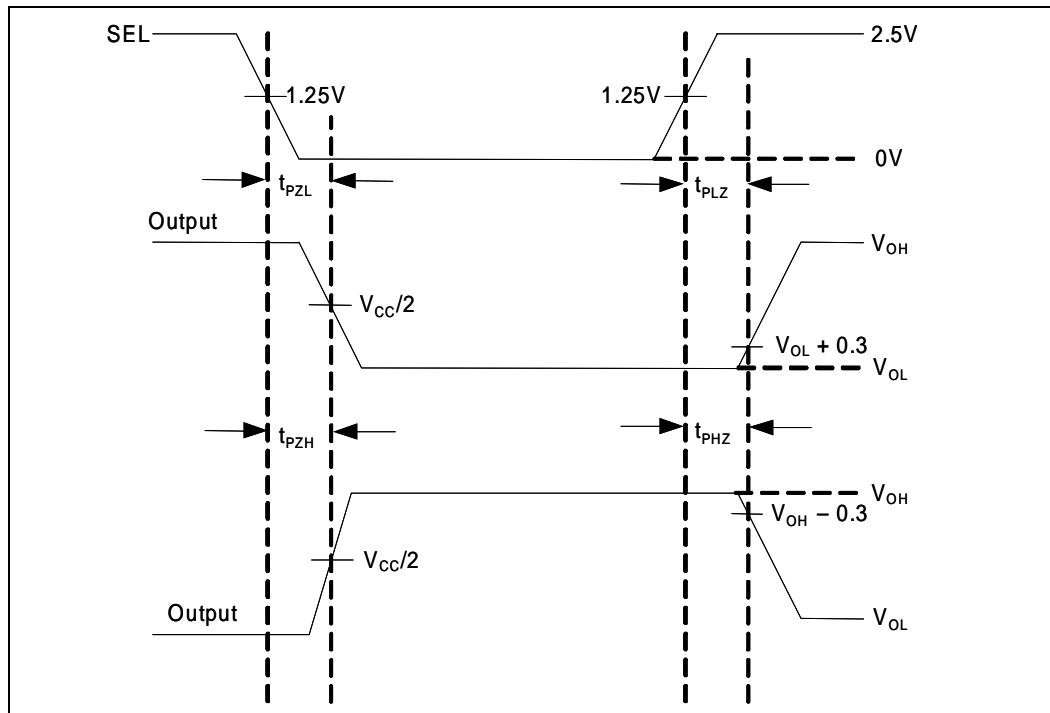
Figure 4.   Enable and Disable Timings

Figure 5.   Output Skew

$$t_{SK}\ (o) = |\ t_{PLHy}\ -t_{PLHx}\ |\ or\ |\ t_{PHLy}\ -t_{PHLx}\ |$$
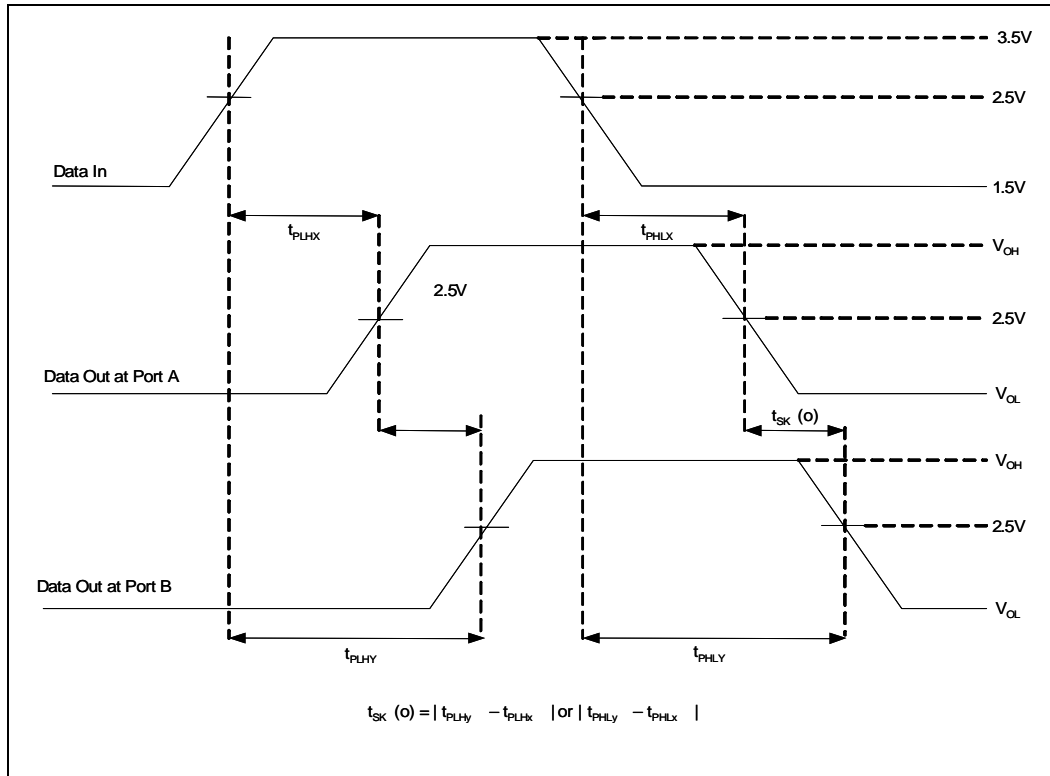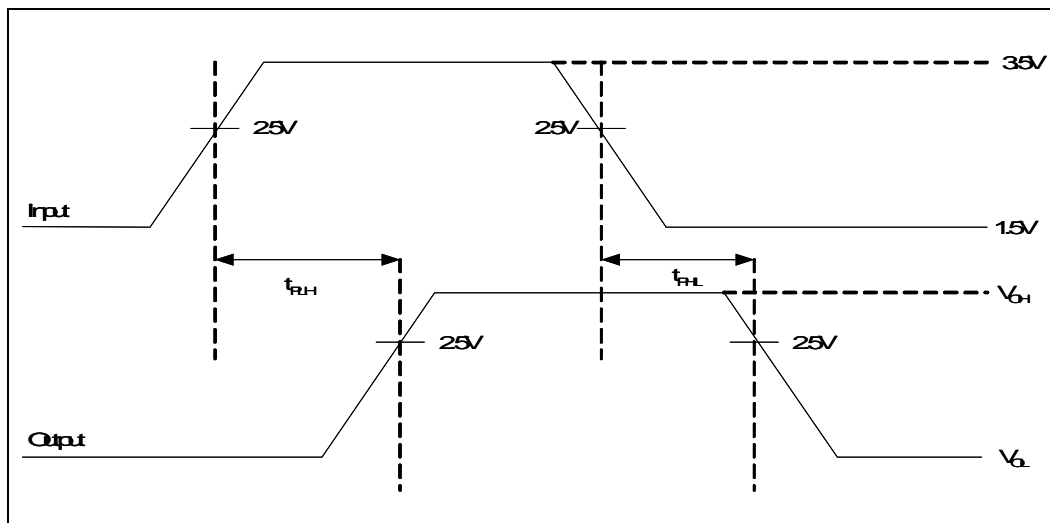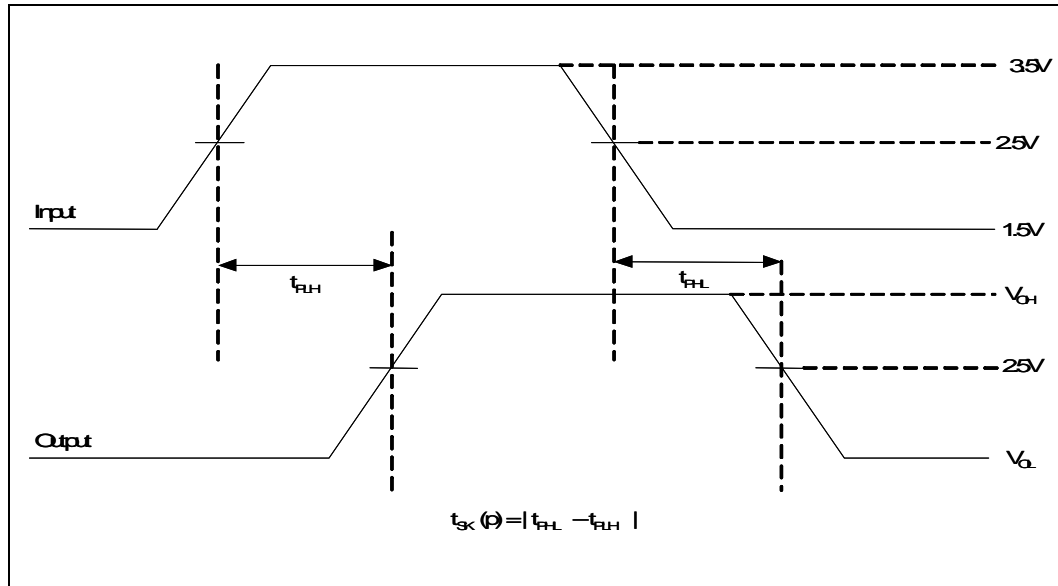
Figure 6.   Propagation Delay Timings

Figure 7.   Pulse Skew

5 ESD Performance

Table 10. ESD Performance

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	IEC-61000-4-2 (A0+ to A2+, A0- to A2-, AClock+, AClock-, B0+ to B2+, B0- to B2-, BClock+, BClock-)	Air Discharge (10 pulses)		±4		kV
		Contact Discharge (10 pulses)		±4		kV
	IEC-61000-4-2 (other pins)	Air Discharge (10 pulses)		±2		kV
		Contact Discharge (10 pulses)		±2		kV

6   Mechanical Data (Body 48L Pitch 0.5mm)

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

TSSOP48 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.1			0.433
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.85	0.9	0.95	0.335	0.354	0.374
b	0.17		0.27	0.0067		0.011
c	0.09		0.20	0.0035		0.0079
D	12.4	12.5	12.6	0.408	0.492	0.496
E	7.95	8.1	8.25	0.313	0.319	0.325
E1	6.0	6.1	6.2	0.236	0.240	0.244
e		0.5 BSC			0.0197 BSC	
K	0°	4°	8°	0°	4°	8°
L	0.50	0.60	0.70	0.020	0.024	0.028

PIN 1 IDENTIFICATION
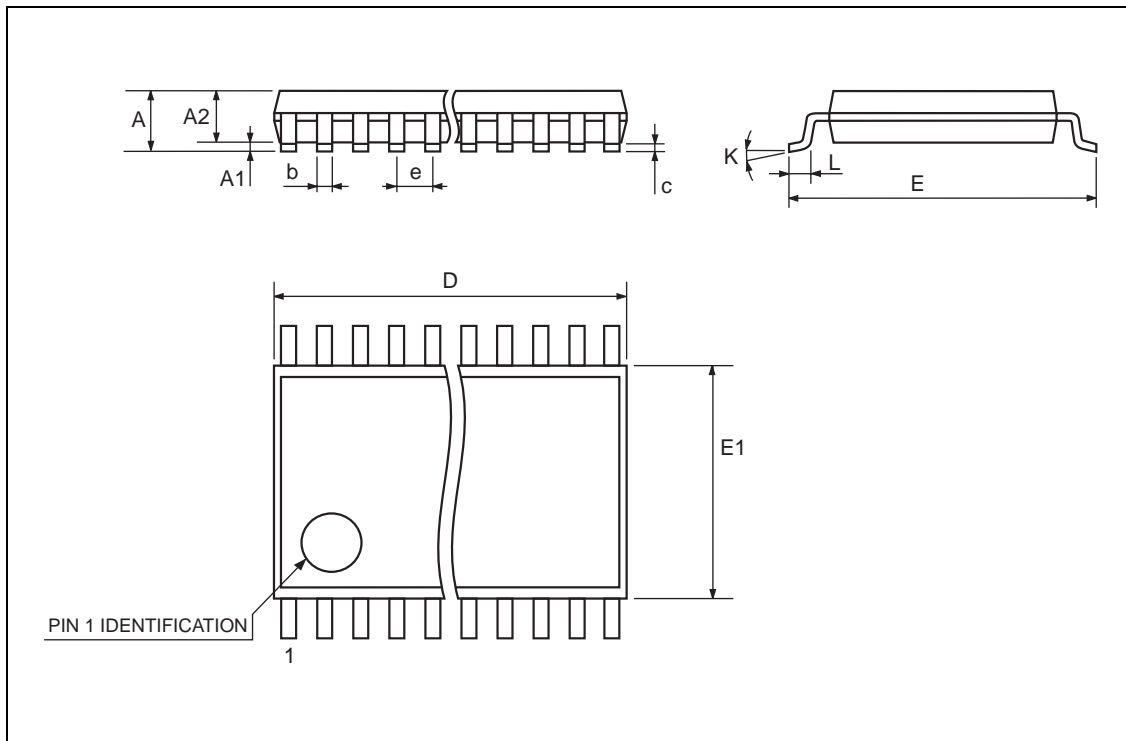
7   Revision History

Date	Revision	Description of Change
09-Sep-2005	1	First issue
03-Jan-2006	2	Added the maximum data rate support. Added crosstalk, off-isolation values at higher frequencies.

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