October 2005
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FAIRCHILD SEMICONDUCTOR®

FSHDMI04

Wide-bandwidth Differential Signaling HDMI Switch (Preliminary)

General Description

The FSHDMI04 is a wide bandwidth switch for routing HDMI Link Data and Clock signals. This device supports data rates up to 1.65Gbps per channel for UXGA resolution. It can also be used to switch other LVDS or TMDS based DVI digital video signals as well as 1000-BaseT Gigabit Ethernet. Possible applications include LCD TV, DVD, Set-Top Box, and notebook computer and other designs with multiple digital video interfaces. The FSHDMI04 switch allows the passage of HDMI link signals with low non-adjacent channel crosstalk and superior OFF-Isolation. This performance is critical to minimize ghost images between active video sources in video applications. The wide bandwidth of this switch allows the high speed differential signal to pass through the switch with minimal additive skew and phase jitter.

Features

- 1.65 Gbps Throughput
- -25dB non-adjacent channel crosstalk at 825MHz
- Isolation ground between channels
- Fast turn on/off time
- Low power consumption (1μA max)
- Control input: TTL compatible
- Available in 48-lead QVSOP package

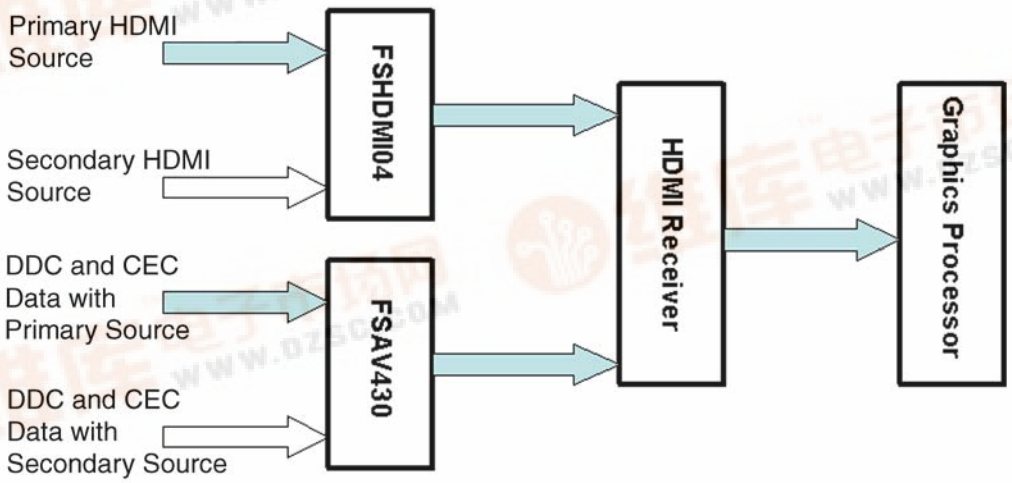
Applications

- UXGA and 1080p DVI and HDMI video source selection

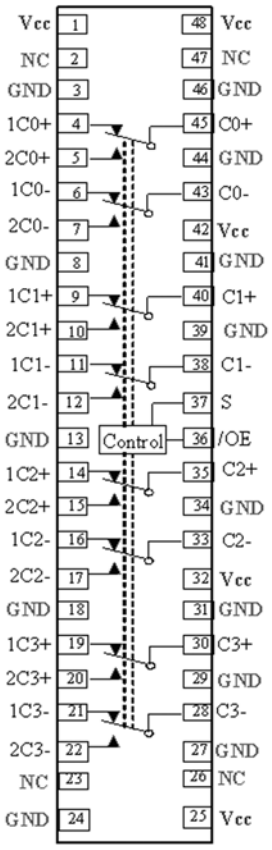
Ordering Code:

Order Number	Package Number	Package Description
FSHDMI04QSPX	MQA48A	48-Lead Quarter Size Very Small Outline Package (QVSOP), JEDEC MO-154, 0.150" Wide

Application Diagram



Pin Assignments



Truth Table

S	$\overline{OE}$	Function
X	H	Disconnected
L	L	$1C_n = C_n$
H	L	$2\ C_n = C_n$

Pin Descriptions

Pin Name	Description
$\overline{OE}$	Bus Switch Enable
S	Select Input
$1C_n$, $2C_n$, $C0_n$, $C1_n$, $C2_n$, $C3_n$	Data Ports

Absolute Maximum Ratings (Note 1)

Supple Voltage (V_{CC})	−0.5V to +4.6V
DC Switch Voltage (V_S)	−0.5V to V_{CC} +0.05
DC Input Voltage (V_{IN}) (Note 2)	−0.5V to +4.6V
DC Input Diode Current (I_{IK})	−50 mA
DC Output (I_{OUT}) Sink Current	128 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
ESD	
Human Body Model	4kV

Recommended Operating Conditions
(Note 3)

Power Supply Operating (V_{CC})	3.0V to 3.6V
Control Input Voltage (V_{IN})	0V to V_{CC}
Switch Input Voltage	0V to V_{CC}
Operating Temperature	−40°C to 85°C

Note 1: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum rating. The Recommended Operating Conditions tables will defined the conditions for actual device operation.

Note 2: The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Note 3: Unused control inputs must be held HIGH or LOW. They may not float

DC Electrical Characteristics (All typical values are for V_{CC} = 3.3V @ 25°C unless otherwise specified)

Symbol	Parameter	V_{CC} (V)	T_A = −40°C to +85°C			Units	Conditions
			Min	Typ (Note 4)	Max		
V_{IK}	Clamp Diode Voltage	3.0			−1.2	V	I_{IN} = −18mA
V_{IH}	Input Voltage HIGH	3.0 - 3.6	2.0			V	
V_{IL}	Input Voltage LOW	3.0 - 3.6			0.8	V	
I_{IN}	Control Input Leakage	3.6			±1.0	μA	V_{IN} = 0 to V_{CC}
I_{OZ}	OFF-STATE Leakage	3.6			±1.0	μA	$0 \le nC_n, C_n \le V_{CC}$
R_{ON}	Switch On Resistance (Note 4)	3.0			15.0	Ω	V_{IN} = V_{CC} − 0.6 to V_{CC}, I_{ON} = 10mA
$R_{ON(FLAT)}$	Switch On Resistance Flatness (Note 4)	3.0			2.0	Ω	V_{IN} = V_{CC} − 0.6 to V_{CC}, I_{ON} = 10mA
I_{CC}	Quiescent Supply Current (Note 5)	3.6			1.0	μA	V_{IN} = 0 or V_{CC}, I_{OUT} = 0
I_{CCT}	Increase in I_{CC} Current per Control Voltage (Note 5)	3.6			50.0	μA	One Input at 3.0V, Others at 0V or V_{CC}

Note 4: Measured by the voltage drop between A and B pins at the indicated current through the switch. On Resistance is determined by the lower of the voltages on the two (A or B) pins.

Note 5: This specification applies to pass gate architecture only.

AC Electrical Characteristics (All typical values are for 25°C unless otherwise specified)

Symbol	Parameter	V_{CC} (V)	T_A = −40°C to +85°C			Units	Conditions	Figure Number
			Min	Typ (Note 6)	Max			
t_{ON}	Turn ON Time S-to-Output	3.0 to 3.6		4.8	6.0	ns	V_{IN} = V_{CC} − 0.5, R_{PU} = 50Ω, C_L = 5pF	Figures 3, 4
t_{OFF}	Turn OFF Time S-to-Output	3.0 to 3.6		2.2	4.0	ns	V_{IN} = V_{CC} − 0.5, R_{PU} = 50Ω, C_L = 5pF	Figures 3, 4
t_{BBM}	Break-Before-Make Time	3.0 to 3.6	1.0				V_{IN} = V_{CC} − 0.5, R_{PU} = 20Ω, C_L = 5pF	Figure 10
t_{PD} (t_{PLH}, t_{PHL})	Switch Propagation Delay (Note 6)	3.0 to 3.6			250	ps	R_{PU} = 50Ω, C_L = 5pF	Figures 3, 9
T_{JITTER}	Total Jitter (DJ + RJ)	3.0 to 3.6			90.0	ps	f = 165MHz Clock with 50% Duty Cycle,	Figure 3
T_{RATIO}	Duty Cycle Ratio		40.0	50.0	60.0	%	RPU = 50Ω, CL = 5pF	
T_{SK1}	Intra-Pair Skew	3.0 to 3.6			90.0	ps	f = 740Mbps, 2^{23}-1 PRBS R_{PU} = 50Ω, C_L = 5pF	Figures 3, 9
	C_n+ to C_n−				70.0		f = 1.65Gbps, 2^{23}-1 PRBS R_{PU} = 50Ω, C_L = 5pF	
T_{SK2}	Inter-Pair Skew	3.0 to 3.6			250	ps	f = 740Mbps, 2^{23}-1 PRBS R_{PU} = 50Ω, C_L = 5pF	Figures 3, 9
	(Between any two switch paths)				250		f = 1.65Gbps, 2^{23}-1 PRBS R_{PU} = 50Ω, C_L = 5pF	
O_{IRR}	OFF-Isolation	3.0 to 3.6		−55.0		dB	R_T = 50Ω, f = 10MHz	Figure 5
		3.0 to 3.6		−32.0			R_T = 50Ω, f = 165MHz	
		3.0 to 3.6		−30.0			R_T = 50Ω, f = 370MHz	
		3.0 to 3.6	−25.0	−27.0			R_T = 50Ω, f = 825MHz	
Xtalk	Non-Adjacent Channel Crosstalk	3.0 to 3.6		−75.0		dB	R_T = 50Ω, f = 10MHz	Figure 6
		3.0 to 3.6		−40.0			R_T = 50Ω, f = 165MHz	
		3.0 to 3.6		−30.0			R_T = 50Ω, f = 370MHz	
		3.0 to 3.6	−25.0	−27.0			R_T = 50Ω, f = 825MHz	
f_{MAX}	Maximum Throughput	3.3		1.65		Gbps		
BW	Bandwidth (Note 6)	3.3		825		MHz	R_T = 50Ω, C_L = 5pF	

Note 6: This specification applies to pass gate architecture ONLY. For active switch design, it allows up to 60mA power consumption. Propagation delay for active architecture design is allowed to be 1ns. 150ps specification applies to pass gate design ONLY. This specification is also not production tested.

Capacitance

Symbol	Parameter	T_A = −40°C to +85°C			Units	Conditions
		Min	Typ	Max		
C_{IN}	Control Pin Input Capacitance		1.5		pF	V_{CC} = 0V
C_{ON}	nC_n ON Capacitance		6.0		pF	V_{CC} = 3.3V
C_{OFF}	Port C_n OFF Capacitance		4.5		pF	V_{CC} = 3.3V

Test Diagrams

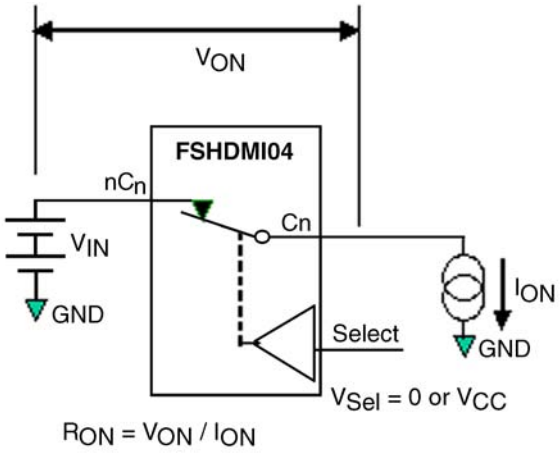
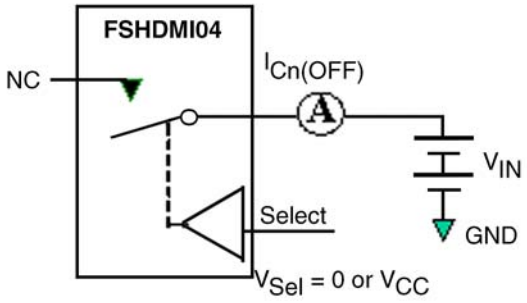
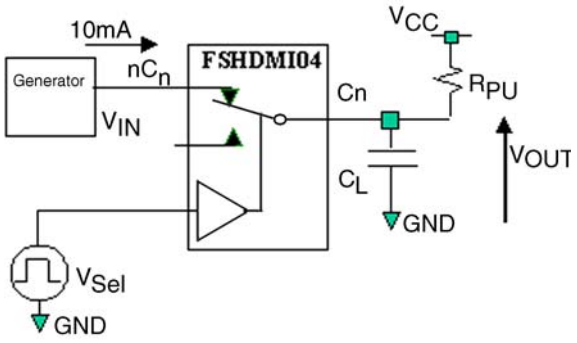


FIGURE 1. On Resistance



Each switch port is tested separately.

FIGURE 2. OFF Leakage



R_{PU} and C_L are functions of application environment (see AC/DC Tables for values of C_L and R_{PU})

C_L includes test fixture and stray capacitance

FIGURE 3.

Test Diagrams (Continued)

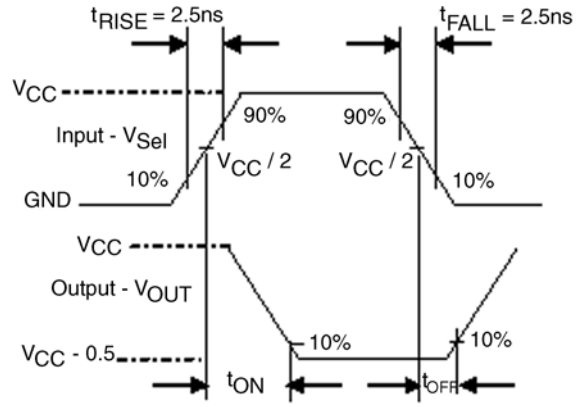
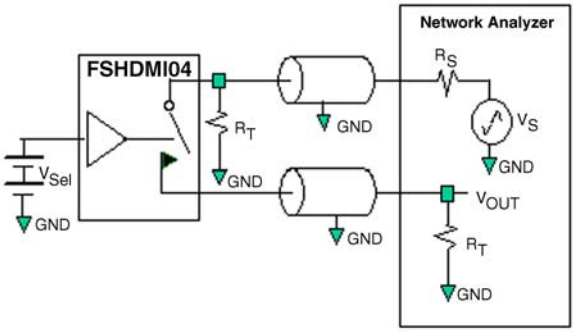


FIGURE 4. Turn ON / Turn OFF Waveforms

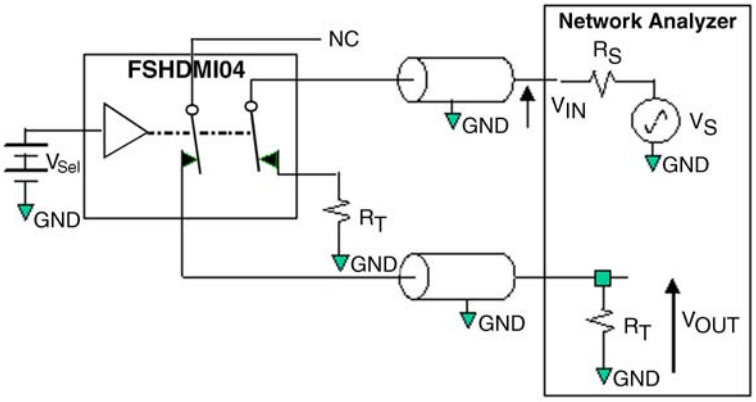


R_S and R_T are functions of the application environment

(see AC/DC Tables for values of R_T)

OFF-Isolation = 20 Log (V_{OUT} / V_{IN})

FIGURE 5. Channel OFF-Isolation



R_S and R_T are functions of the application environment

(see AC/DC Tables for values of R_T)

Crosstalk = 20 Log (V_{OUT} / V_{IN})

FIGURE 6. Non-adjacent Channel-to-Channel Crosstalk

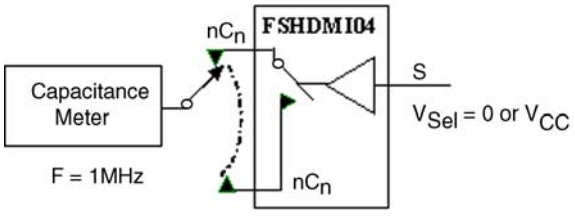


FIGURE 7. Channel OFF-Capacitance

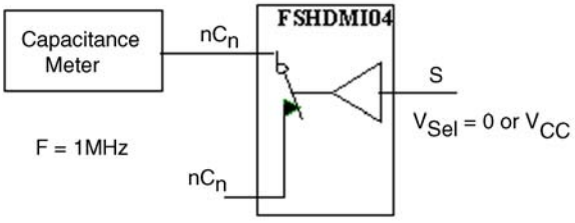


FIGURE 8. Channel ON-Capacitance

Test Diagrams (Continued)

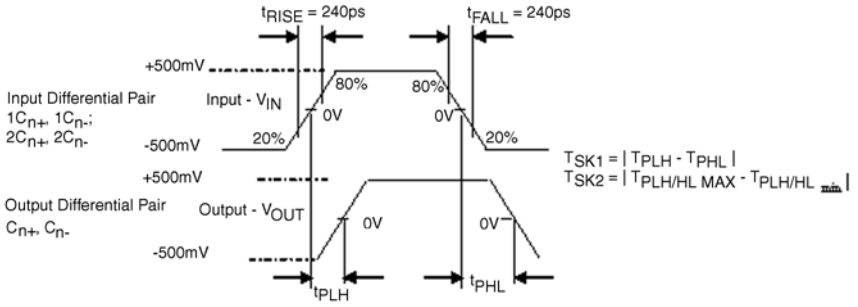
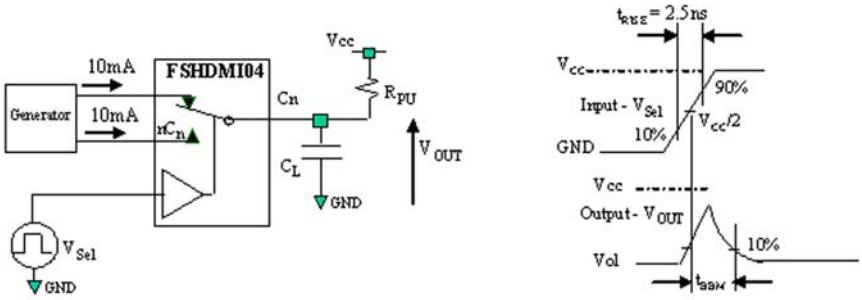


FIGURE 9. Intra and Inter Pair Skew, t_{PD}

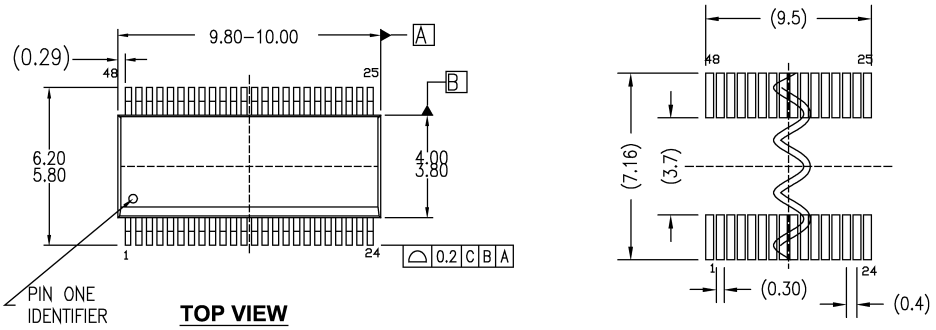


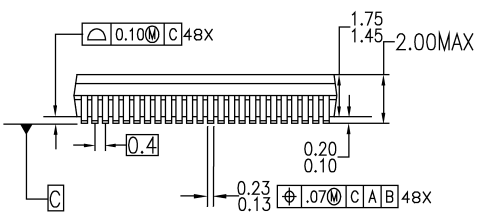
R_{PU} and C_L are functions of the application environment (see AC/DC Tables for values of C_L and R_{PU})

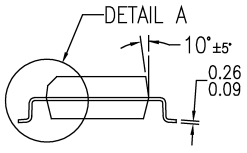
C_L includes test fixture and stray capacitance.

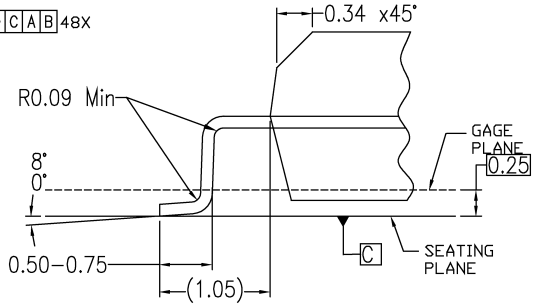
FIGURE 10. Break-Before-Make

Physical Dimensions inches (millimeters) unless otherwise noted









NOTES:

A. THIS PACKAGE CONFORMS TO JEDEC MO-154 VERSION AB
B. ALL DIMENSIONS IN MILLIMETERS
C. DRAWING CONFORMS TO ASME Y14.5M-1994
D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

MQA48AREVA

48-Lead Quarter Size Very Small Outline Package (QVSOP), JEDEC MO-154, 0.150" Wide
Package Number MQA48A

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

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