FAIRCHILD
SEMICONDUCTOR®

January 2006

FSHDMI04
Wide-bandwidth Differential Signaling HDMI Switch

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, notebook computers 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
- 8kV ESD Protection
- -25dB non-adjacent channel crosstalk at 825MHz
- Isolation ground between channels
- Low skew
  - Inter-pair skew <150ps
  - Inter-pair skew <90ps
- Fast turn on/off time
- Low power consumption (1µA max)
- Control input: TTL compatible
- Available in 48-lead QVSOP package

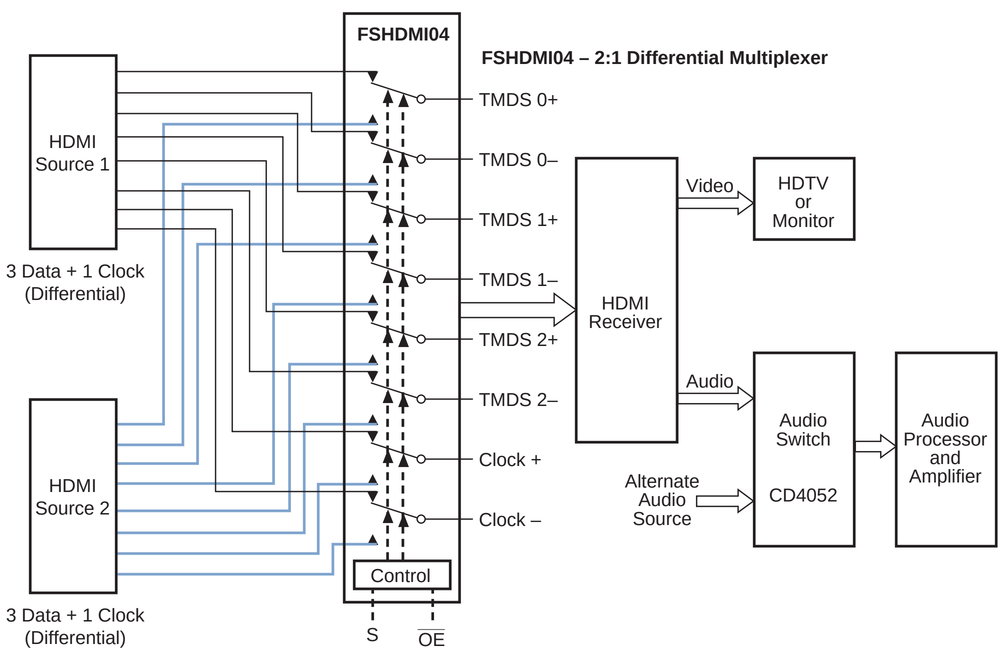
Applications

- UXGA and 1080p DVI and HDMI video source selection

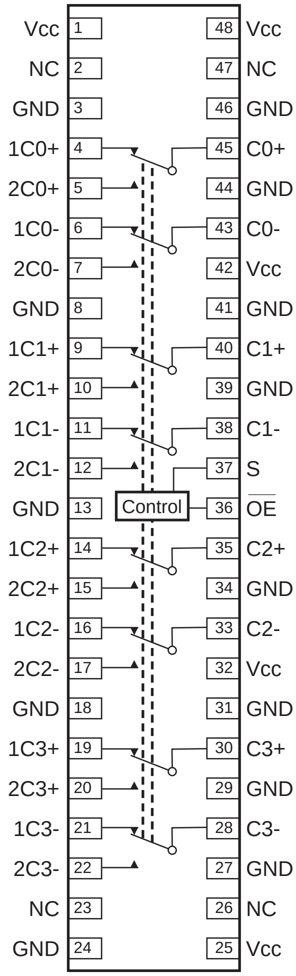
Ordering Information

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

(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 ratings. The “Recommended Operating Conditions” table will define the conditions for actual device operation.)

Symbol	Parameter	Rating
V_{CC}	Supple Voltage	–0.5V to +4.6V
V_S	DC Switch Voltage	–0.5V to V_{CC} +0.05
V_{IN}	DC Input Voltage[1]	–0.5V to +4.6V
I_{IK}	DC Input Diode Current	–50 mA
I_{OUT}	DC Output Sink Current	128 mA
T_{STG}	Storage Temperature Range	–65°C to +150°C
	ESD, Human Body Model	8,000V

Recommended Operating Conditions[2]

Symbol	Parameter	Rating
V_{CC}	Power Supply Operating	3.0V to 3.6V
V_{IN}	Control Input Voltage	0V to V_{CC}
	Switch Input Voltage	0V to V_{CC}
	Operating Temperature	–40°C to 85°C

DC Electrical Characteristics

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

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = –40°C to +85°C			Units
				Min	Typ	Max	
V_{IK}	Clamp Diode Voltage	I_{IN} = –18mA	3.0			–1.2	V
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	V_{IN} = 0 to V_{CC}	3.6			±1.0	µA
I_{OZ}	OFF-STATE Leakage	$0 \leq nC_n, C_n \leq V_{CC}$	3.6			±1.0	µA
R_{ON}	Switch On Resistance[3]	$V_{IN} = V_{CC} - 0.6$ to V_{CC}, I_{ON} = 10mA	3.0		12.0	19.0	Ω
$R_{ON(FLAT)}$	Switch On Resistance Flatness[4]	$V_{IN} = V_{CC} - 0.6$ to V_{CC}, I_{ON} = 10mA	3.0		1.0		Ω
I_{CC}	Quiescent Supply Current	V_{IN} = 0 or V_{CC}, I_{OUT} = 0	3.6			1.0	µA

Notes:

1. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.
2. Unused control inputs must be held HIGH or LOW. They may not float.
3. 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.
4. Flatness is defined as the difference between the maximum and minimum value On Resistance over the specified range of conditions.

AC Electrical Characteristics

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

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = –40°C to +85°C			Units	Figure Number
				Min	Typ	Max		
t_{ON}	Turn ON Time S, $\overline{OE}$-to-Output	$V_{IN} = V_{CC} – 0.5$, $R_{PU} = 50\Omega$, C_L = 5pF	3.0 to 3.6		4.0	6.0	ns	Figure 5 Figure 6
t_{OFF}	Turn OFF Time S, $\overline{OE}$-to-Output	$V_{IN} = V_{CC} – 0.5$, $R_{PU} = 50\Omega$, C_L = 5pF	3.0 to 3.6		2.0	4.0	ns	Figure 5 Figure 6
t_{BBM}	Break-Before-Make Time	$V_{IN} = V_{CC} – 0.5$, $R_{PU} = 20\Omega$, C_L = 5pF	3.0 to 3.6		3.0			Figure 12
t_{PD} (t_{PLH}, t_{PHL})	Switch Propagation Delay	$R_{PU} = 50\Omega$, C_L = 5pF	3.0 to 3.6			250	ps	Figure 5 Figure 11
T_{JITTER}	Total Jitter (DJ + RJ)	f = 165MHz Clock with 50% Duty Cycle, RPU = 50Ω, CL = 5pF	3.0 to 3.6		55.0		ps	Figure 5
T_{RATIO}	Duty Cycle Ratio				50.0		%	
T_{SK1}	Intra-Pair Skew C_n+ to C_n– [5]	f = 1.65Gbps, 2^{23}-1 PRBS $R_{PU} = 50\Omega$, C_L = 5pF	3.0 to 3.6		55.0	90.0	ps	Figure 5 Figure 11
T_{SK2}	Inter-Pair Skew[5] (Between any two switch paths)	f = 1.65Gbps, 2^{23}-1 PRBS $R_{PU} = 50\Omega$, C_L = 5pF	3.0 to 3.6		90.0	150	ps	Figure 5 Figure 11
O_{IRR}	OFF-Isolation	$R_T = 50\Omega$, f = 370MHz	3.0 to 3.6		–35.0		dB	Figure 7
		$R_T = 50\Omega$, f = 825MHz	3.0 to 3.6		–25.0			
Xtalk	Non-Adjacent Channel Crosstalk	$R_T = 50\Omega$, f = 370MHz	3.0 to 3.6		–30.0		dB	Figure 8
		$R_T = 50\Omega$, f = 825MHz	3.0 to 3.6		–25.0			
f_{MAX}	Maximum Throughput		3.3		1.65		Gbps	

Notes:

5. Guaranteed by characteristics and design.

Capacitance

Symbol	Parameter	Conditions	T_A = –40°C to +85°C			Units
			Min	Typ	Max	
C_{IN}	Control Pin Input Capacitance	V_{CC} = 0V		1.1		pF
C_{ON}	nC_n ON Capacitance	V_{CC} = 3.3V		6.0		pF
C_{OFF}	Port C_n OFF Capacitance	V_{CC} = 3.3V		2.5		pF

Typical Characteristics

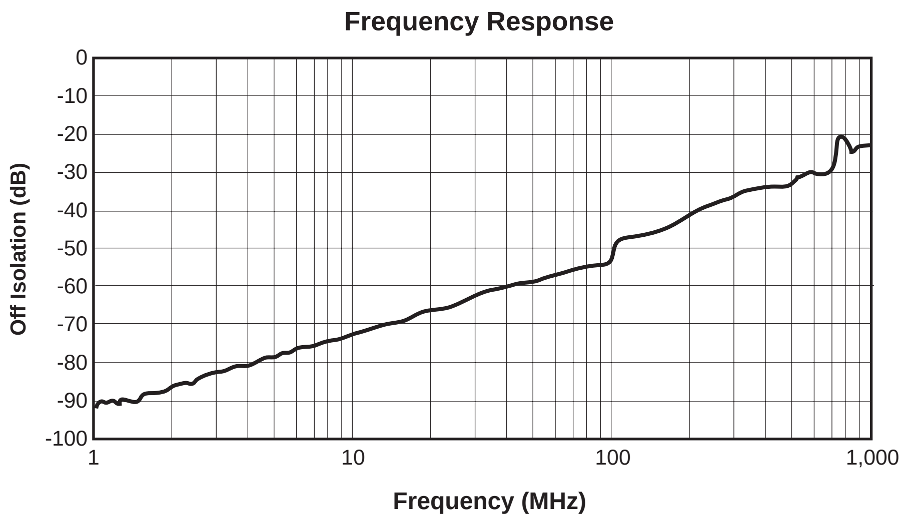


Figure 1. Off-Isolation, V_{CC} = 3.3V

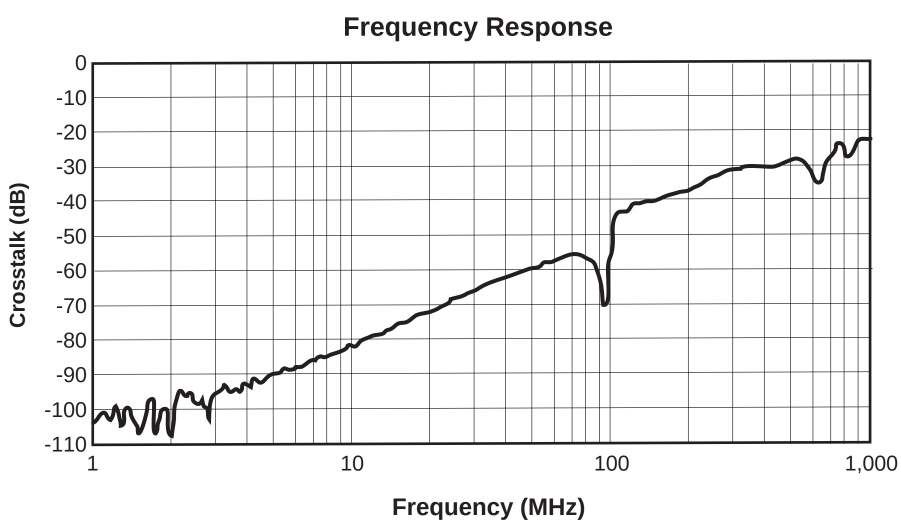


Figure 2. Crosstalk, V_{CC} = 3.3V

Test Diagrams

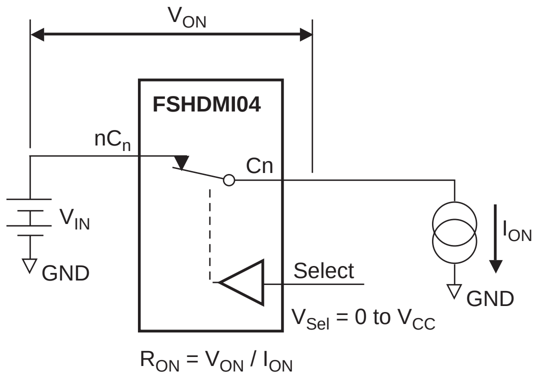
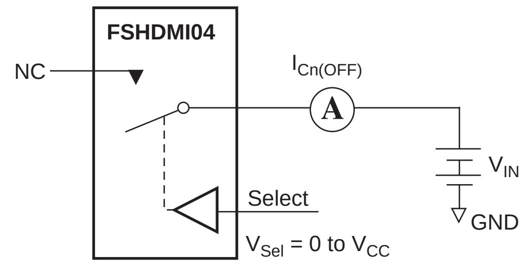
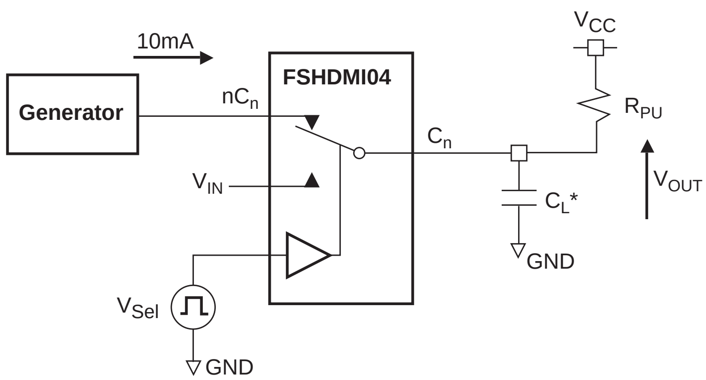


Figure 3. On Resistance



Each switch port is tested separately.

Figure 4. 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 fixture and stray capacitance

Figure 5.

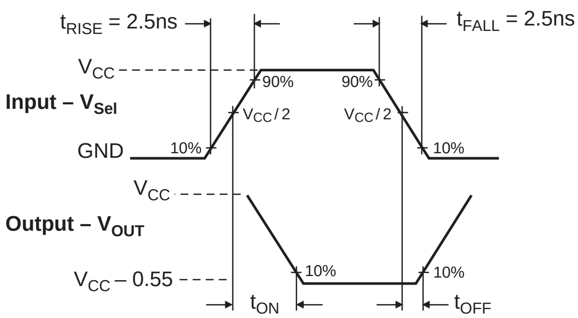
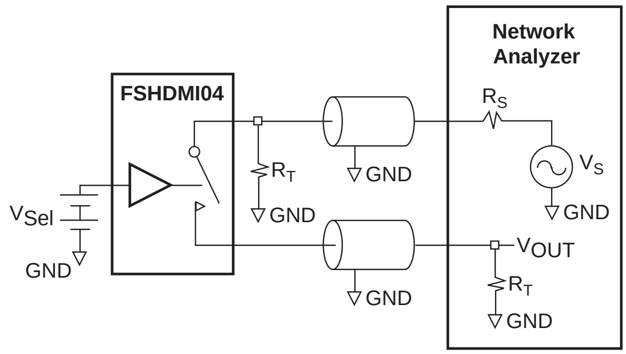


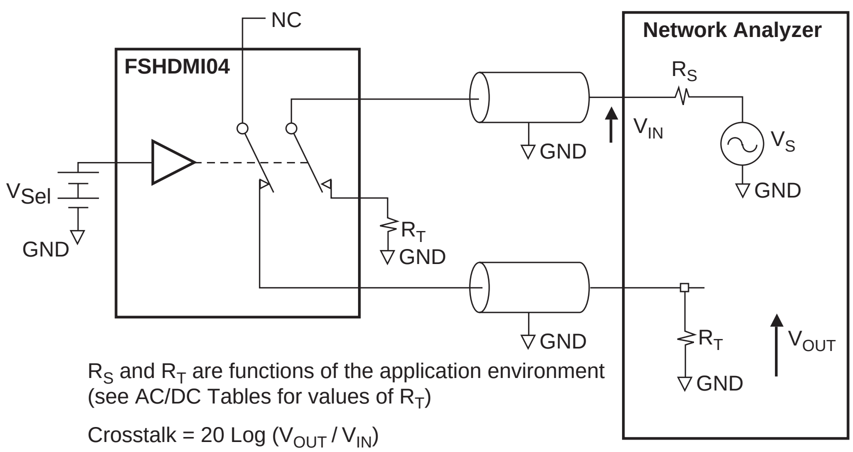
Figure 6. Turn ON / Turn OFF Waveforms



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 7. 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 8. Non-adjacent Channel-to-Channel Crosstalk

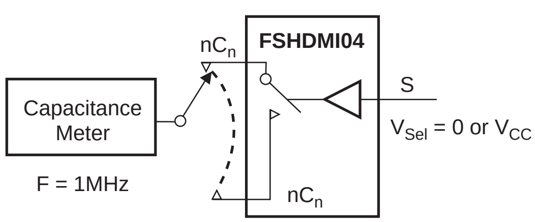


Figure 9. Channel OFF-Capacitance

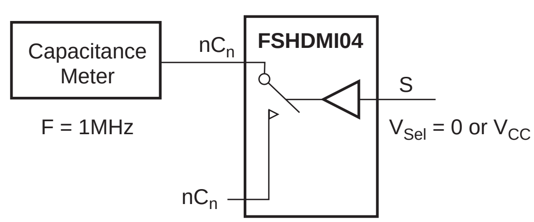


Figure 10. Channel ON-Capacitance

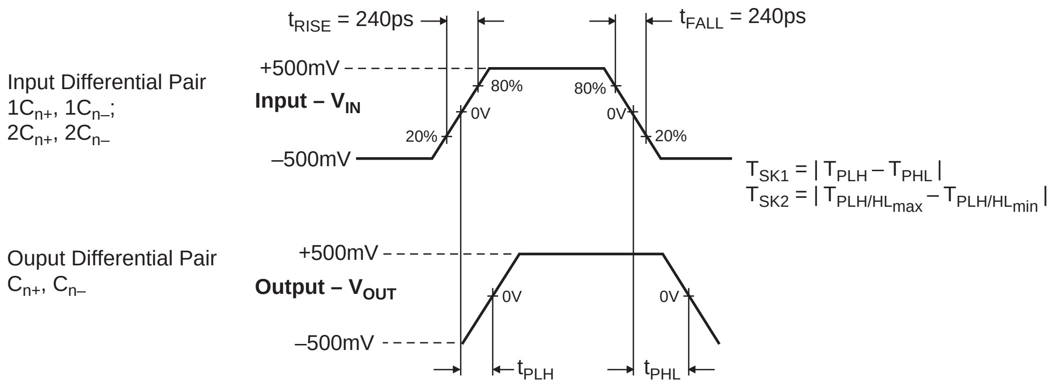
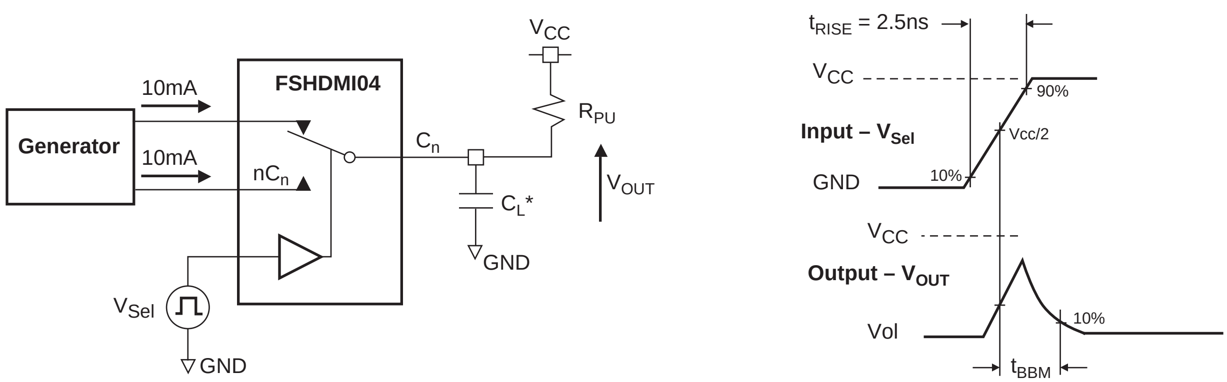


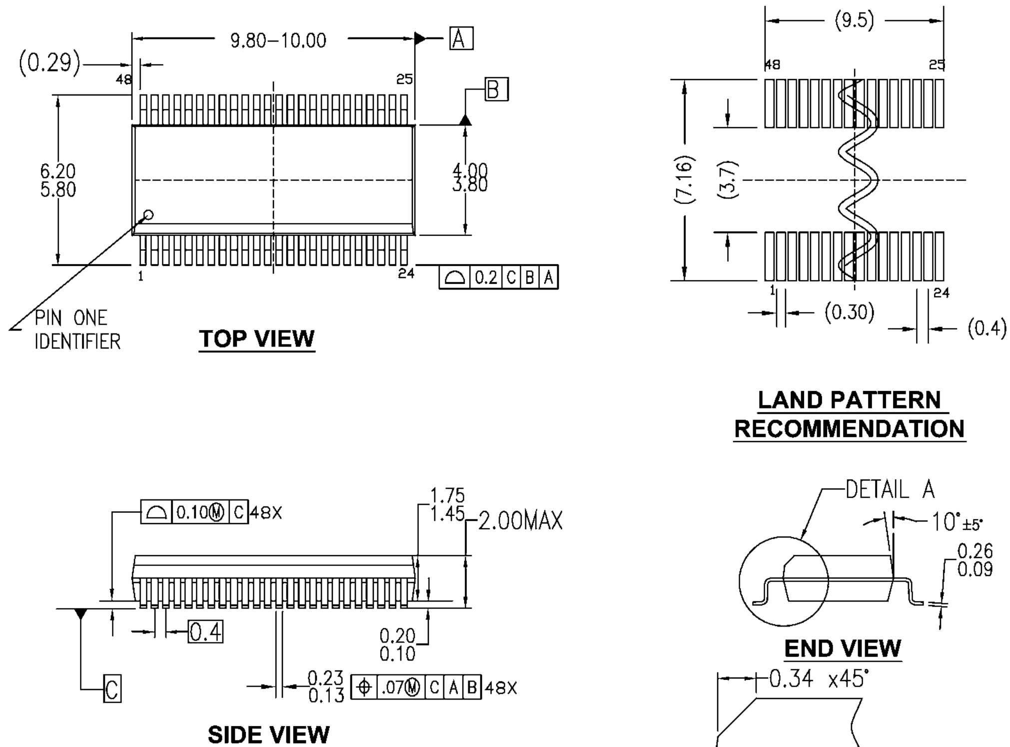
Figure 11. Intra and Inter Pair Skew, t_{PD}

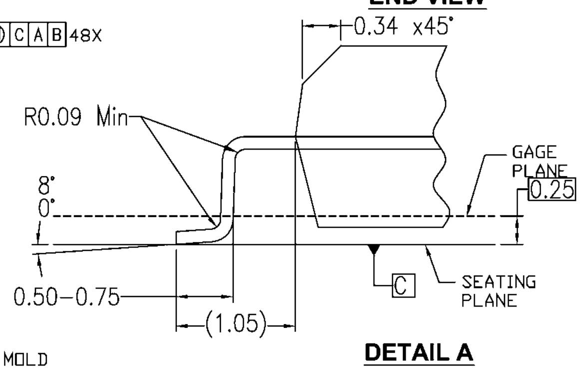


R_{PU} and C_L are functions of application environment (see AC/DC Tables for values of C_L and R_{PU})
*C_L includes fixture and stray capacitance

Figure 12. 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

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™
ActiveArray™
Bottomless™
Build it Now™
CoolFET™
CROSSVOLT™
DOME™
EcoSPARK™
E^2CMOS™
EnSigna™
FACT™
FACT Quiet Series™
FAST®
FASTr™
FPS™
FRFET™
GlobalOptoisolator™
GTO™
HiSeC™
I^2C™
i-Lo™
ImpliedDisconnect™
IntelliMAX™
Across the board. Around the world.™
The Power Franchise®
Programmable Active Droop™
ISOPLANAR™
LittleFET™
MICROCOUPLER™
MicroFET™
MicroPak™
MICROWIRE™
MSX™
MSXPro™
OCX™
OCXPro™
OPTOLOGIC®
OPTOPLANAR™
PACMAN™
POP™
Power247™
PowerEdge™
PowerSaver™
PowerTrench®
QFET®
QS™
QT Optoelectronics™
Quiet Series™
RapidConfigure™
RapidConnect™
μSerDes™
ScalarPump™
SILENT SWITCHER®
SMART START™
SPM™
Stealth™
SuperFET™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TinyLogic®
TINYOPTO™
TruTranslation™
UHC™
UltraFET®
UniFET™
VCX™
Wire™

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILDíS PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

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

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I17