FAIRCHILD SEMICONDUCTOR®

October 2006

FSHDMI04
Wide-Bandwidth Differential Signaling HDMI Switch

Features

- 1.65 Gbps throughput
- 8kV ESD protection
- -26dB non-adjacent channel crosstalk at 825MHz
- Isolation ground between channels
- Low skew
  - Inter-pair skew <150ps
  - Intra-pair skew <90ps
- Fast turn on/off time
- Low power consumption (1µA maximun)
- Control input: TTL compatible

Applications

- UXGA and 1080p DVI and HDMI video source selection

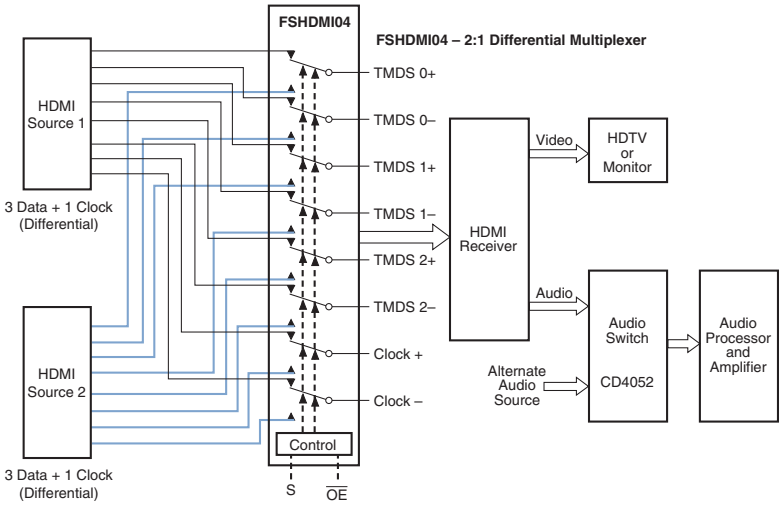
General Description

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 TMDS-based DVI digital video streams. 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.

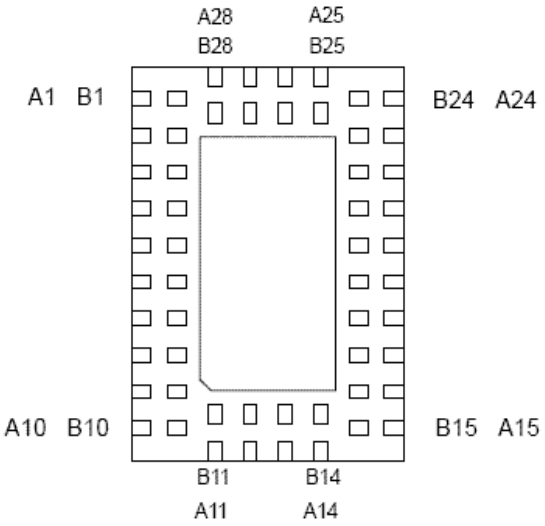
Ordering Information

Order Number	Package Number	Package Description
FSHDMI04QSPX	MQA48A	48-Lead Quarter Size Very Small Outline Package (QVSOP), JEDEC MO-154, 0.150inches Wide
FSHDMI04MTDX	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
FSHDMI04BQX (Preliminary)	MLP56	56-Lead Molded Leadless Package (MLP), 5x7mm Wide

Applications Diagram



Pin Assignments



Pin	Function	Pin	Function	Pin	Function
A1	NC	A21	C1-	B13	NC
A2	2C0-	A22	C1+	B14	C3-
A3	1C1+	A23	VCC	B15	GND
A4	1C1-	A24	NC	B16	C3+
A5	2C1-	A25	GND	B17	VCC
A6	GND	A26	VCC	B18	GND
A7	1C2+	A27	Vcc	B19	NC
A8	1C2-	A28	GND	B20	NC
A9	GND	B1	2C0+	B21	GND
A10	NC	B2	1C0-	B22	GND
A11	2C3-	B3	GND	B23	C0-
A12	GND	B4	2C1+	B24	GND
A13	VCC	B5	NC	B25	C0+
A14	GND	B6	NC	B26	NC
A15	NC	B7	2C2+	B27	NC
A16	GND	B8	2C2-	B28	1C0+
A17	C2-	B9	1C3+		
A18	C2+	B10	2C3+		
A19	OE	B11	1C3-		
A20	S	B12	NC		

Figure 1. MLP Pin Assignments

Pin Assignments

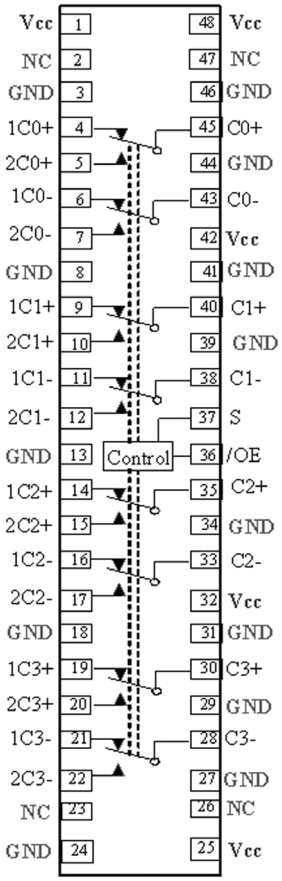


Figure 2. QVSOP and TSSOP Pin Assignments

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 defines 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}
T_A	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 ≤ nC_n, C_n ≤ 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} = 50Ω, C_L = 5pF	3.0 to 3.6		4.0	6.0	ns	Figure 7 Figure 8
t_{OFF}	Turn OFF Time S, $\overline{OE}$-to-Output	V_{IN} = V_{CC} − 0.5, R_{PU} = 50Ω, C_L = 5pF	3.0 to 3.6		2.0	4.0	ns	Figure 7 Figure 8
t_{BBM}	Break-Before-Make Time	V_{IN} = V_{CC} − 0.5, R_{PU} = 20Ω, C_L = 5pF	3.0 to 3.6		3.0			Figure 14
t_{PD} (t_{PLH}, t_{PHL})	Switch Propagation Delay	R_{PU} = 50Ω, C_L = 5pF	3.0 to 3.6			250	ps	Figure 7 Figure 13
T_{JITTER}	Total Jitter (DJ + RJ)	f = 165MHz Clock with 50% Duty Cycle, RPU = 50Ω, C_L = 5pF	3.0 to 3.6		55.0		ps	Figure 7
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} = 50Ω, C_L = 5pF	3.0 to 3.6		55.0	90.0	ps	Figure 7 Figure 13
T_{SK2}	Inter-Pair Skew(5) (Between any two switch paths)	f = 1.65Gbps, 2^{23}-1 PRBS R_{PU} = 50Ω, C_L = 5pF	3.0 to 3.6		90.0	150.0	ps	Figure 7 Figure 13
O_{IRR}	OFF-Isolation	R_T = 50Ω, f = 370MHz	3.0 to 3.6		−35.0		dB	Figure 9
		R_T = 50Ω, f = 825MHz	3.0 to 3.6		−25.0			
Xtalk	Non-Adjacent Channel Crosstalk	R_T = 50Ω, f = 370MHz	3.0 to 3.6		−30.0		dB	Figure 10
		R_T = 50Ω, f = 825MHz	3.0 to 3.6		−26.0			
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

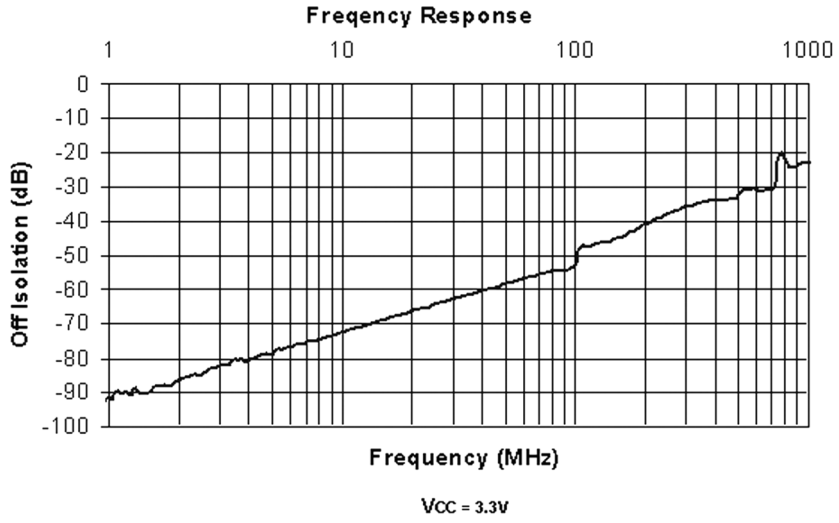


Figure 3. Off- Isolation, V_{CC} = 3.3V

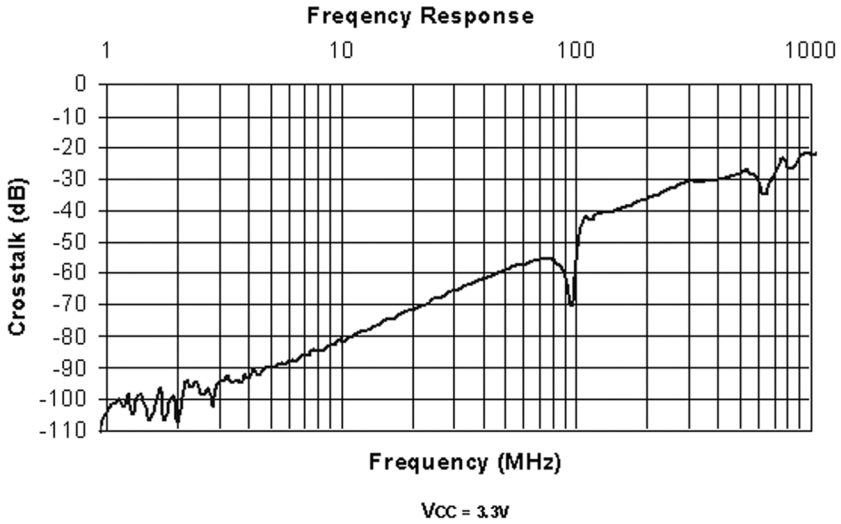


Figure 4. Crosstalk, V_{CC} =3.3CV

Test Diagrams

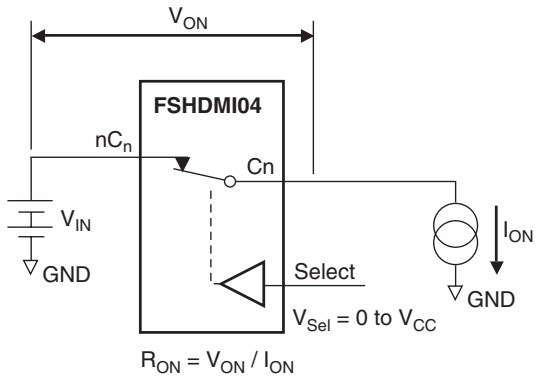
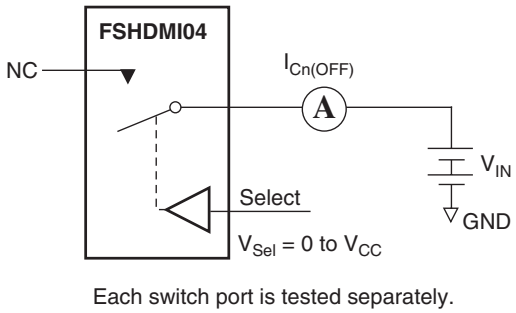
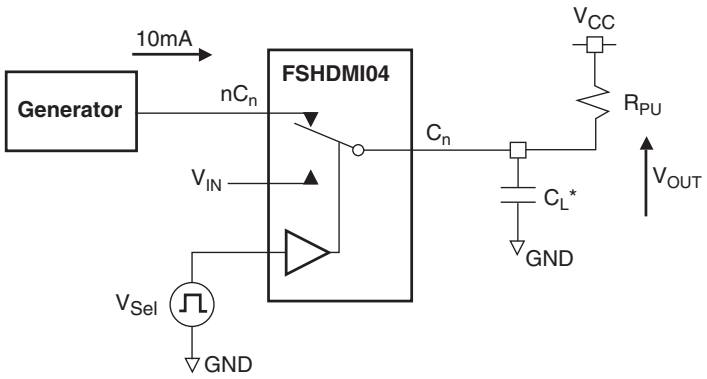


Figure 5. On Resistance



Each switch port is tested separately.

Figure 6. 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 7. AC Test Circuit Load

Test Diagrams (Continued)

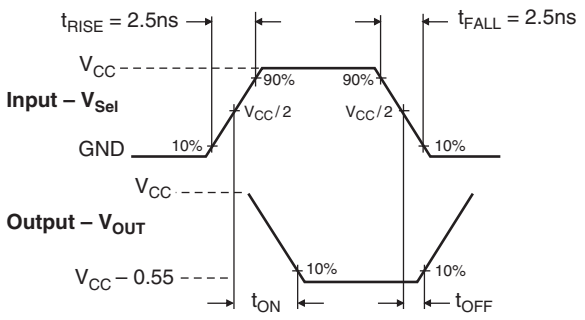
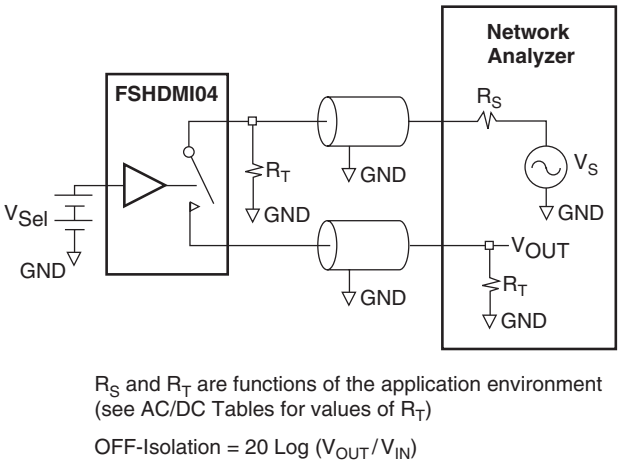


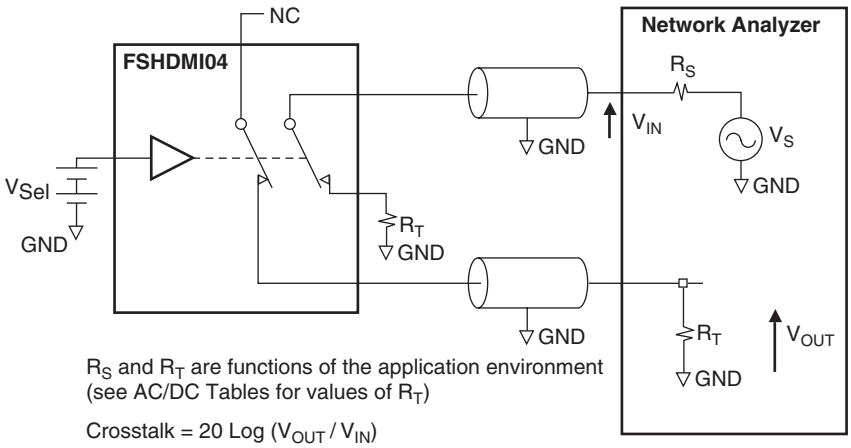
Figure 8. Turn ON / Turn OFF Waveforms



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 9. 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 10. Non-adjacent Channel-to-Channel Crosstalk

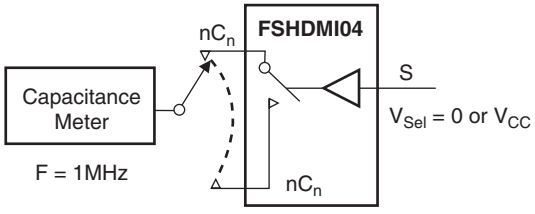


Figure 11. Channel OFF-Capacitance

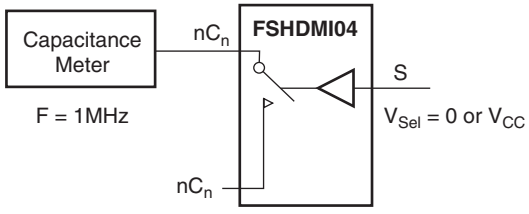


Figure 12. Channel ON-Capacitance

Test Diagrams (Continued)

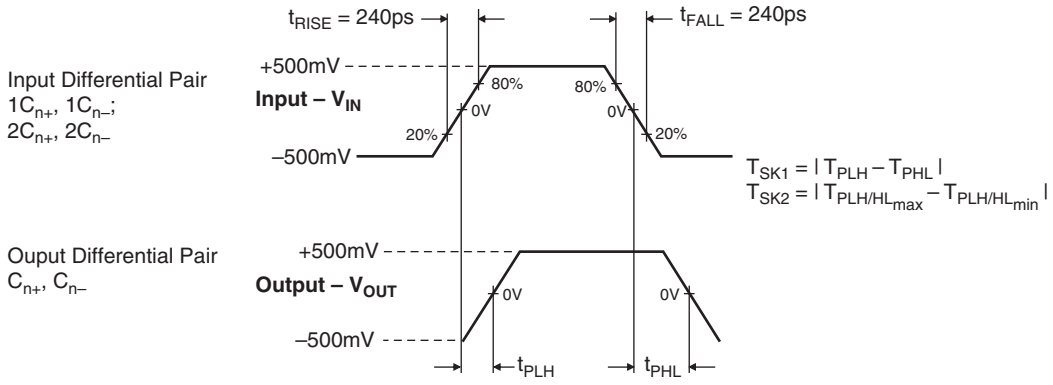
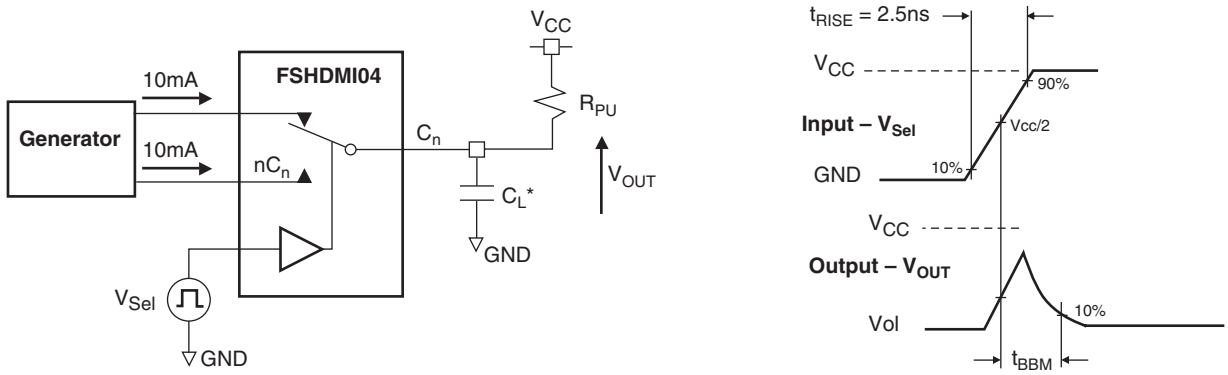


Figure 13. Intra- and Inter-Pair Skew, t_{PD}

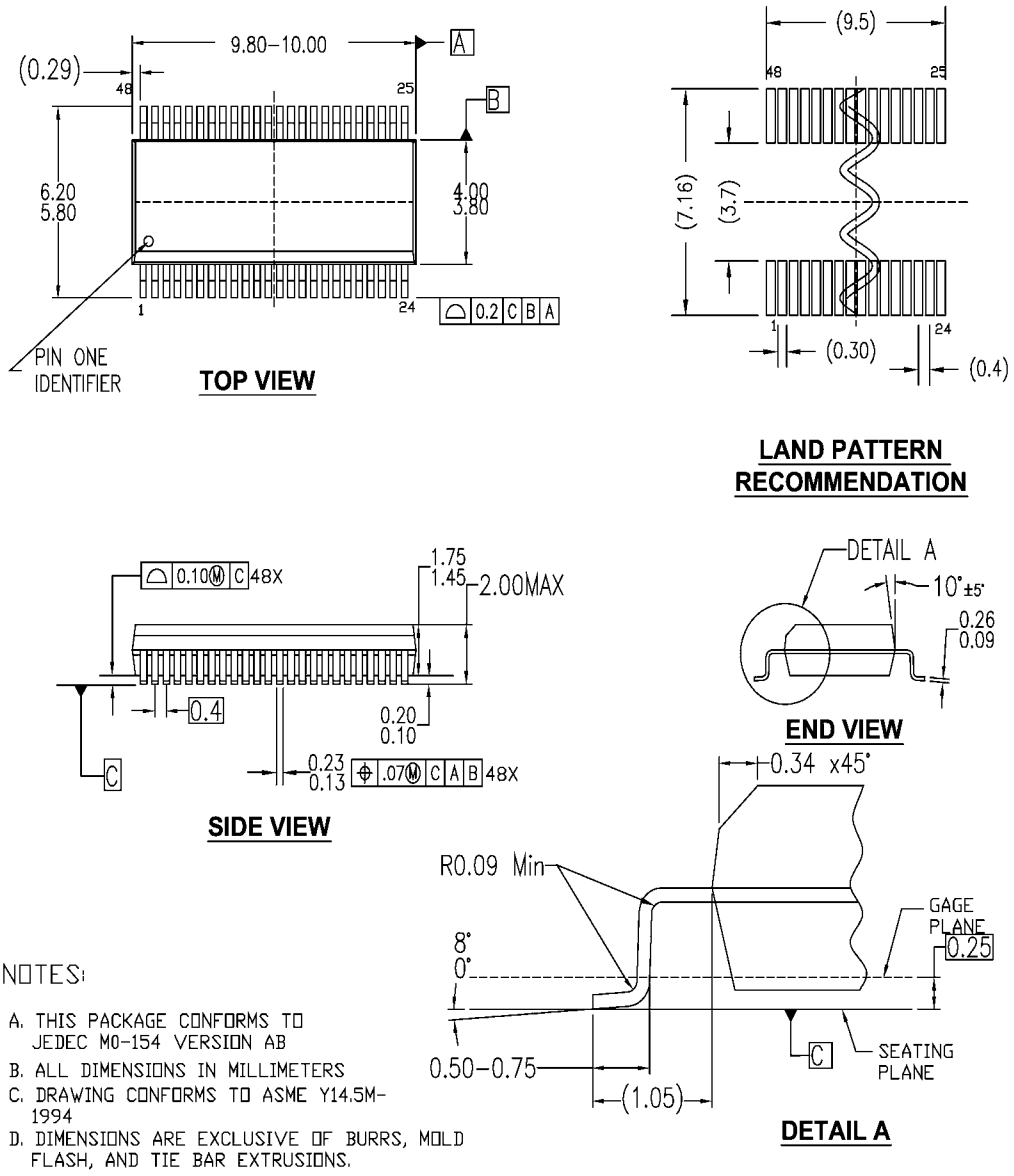


R_{PU} and C_L are functions of application environment (see AC/DC Tables for values of C_L and R_{PU})
*C_L includes fixture and stray capacitance

Figure 14. Break-Before-Make

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



NOTES:

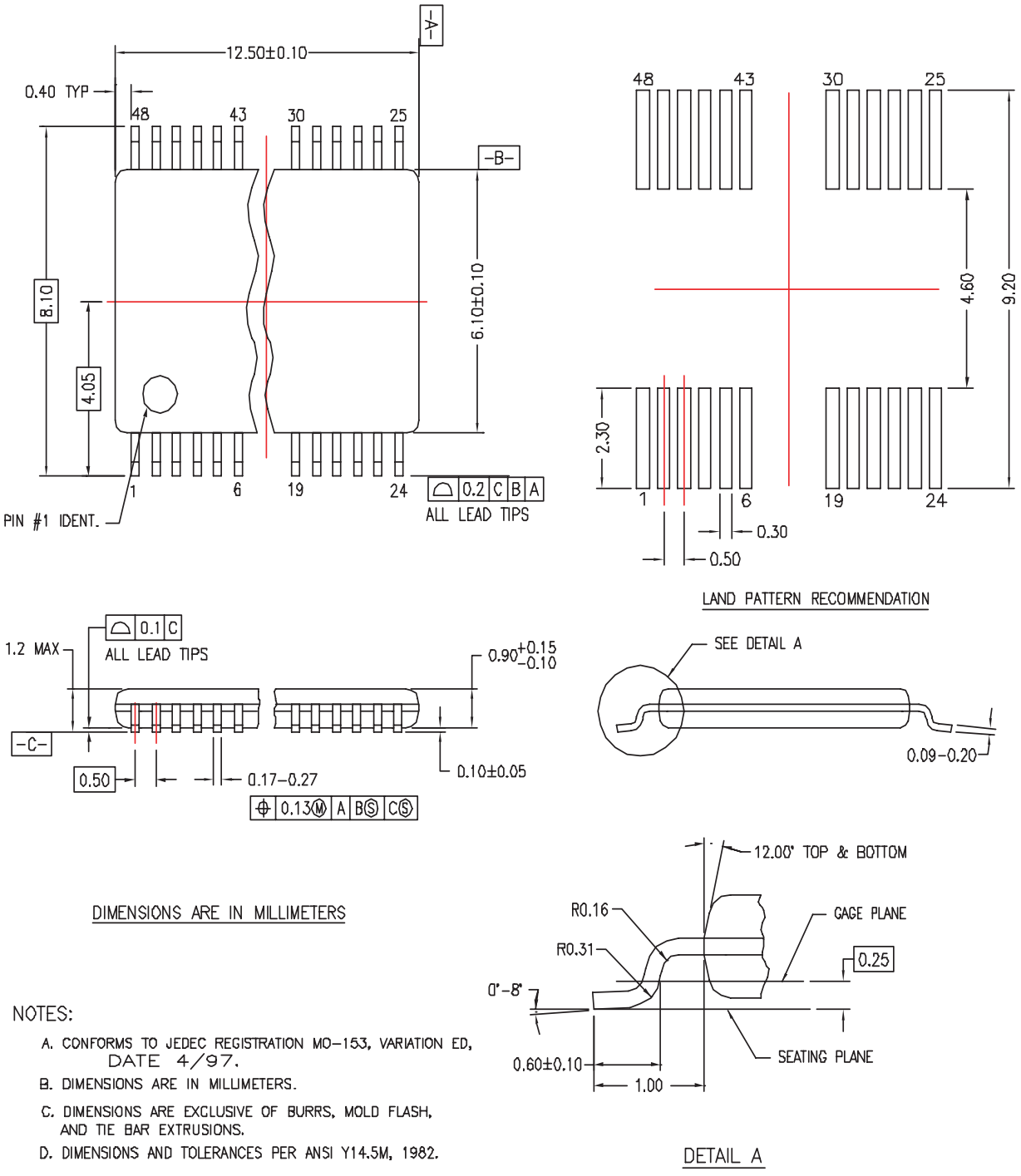
A. THIS PACKAGE CONFORMS TO JEDEC MO-154 VERSION AB
B. ALL DIMENSIONS IN MILLIMETERS
C. DRAWING CONFORMS TO ASME Y14.5M-1994
D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

MQA48AREVA

Figure 15. 48-Lead Quarter Size Very Small Outline Package (QVSOP), JEDEC MO-154, 0.150inches Wide

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION ED, DATE 4/97.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

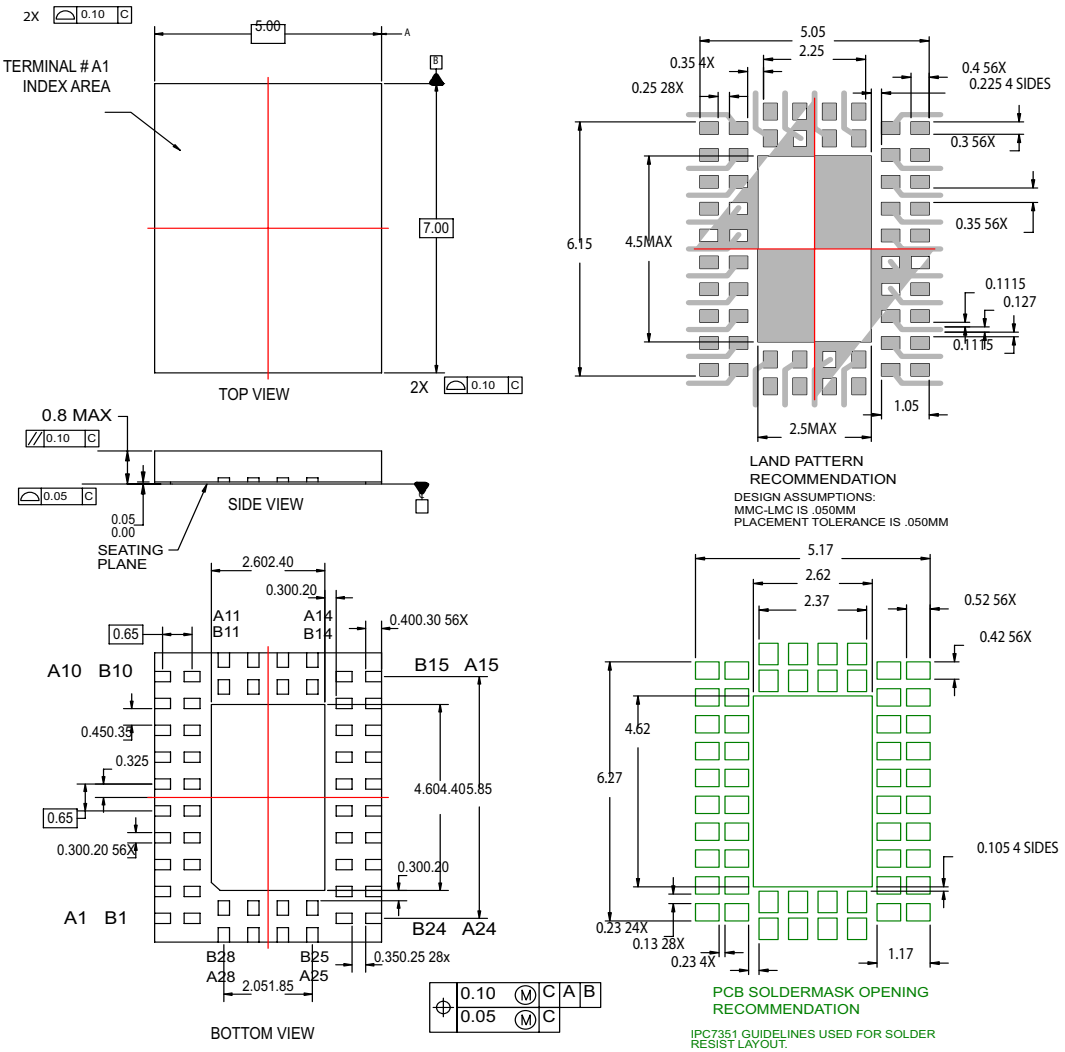
D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTD48REVC

Figure 16. 48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

A. NOT CURRENTLY REGISTERED WITH ANY STANDARDS BODY.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
D. PRELIMINARY DRAWING SUBJECT TO REVISION.

MLP56Arev2

Figure 17. 56-Lead Molded Leadless Package (MLP) 5x7mm

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