74VHC153
Dual 4-Input Multiplexer

May 2007

Features

- High Speed: t_{PD} = 5.0ns at T_A = 25°C
- Low power dissipation: I_{CC} = 4μA (Max.) at T_A = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Power down protection is provided on all inputs
- Pin and function compatible with 74HC153

General Description

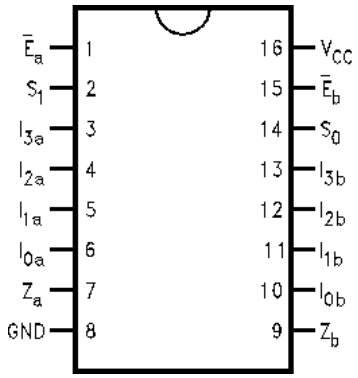
The VHC153 is an advanced high-speed CMOS device fabricated with silicon gate CMOS technology. It achieves the high-speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The VHC153 is a high-speed Dual 4-Input Multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the VHC153 can act as a function generator and generate any two functions of three variables. An input protection circuit insures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

Ordering Information

Order Number	Package Number	Package Description
74VHC153M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHC153SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHC153MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter “X” to the ordering number.

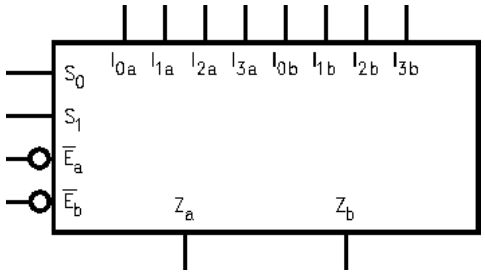
Connection Diagram



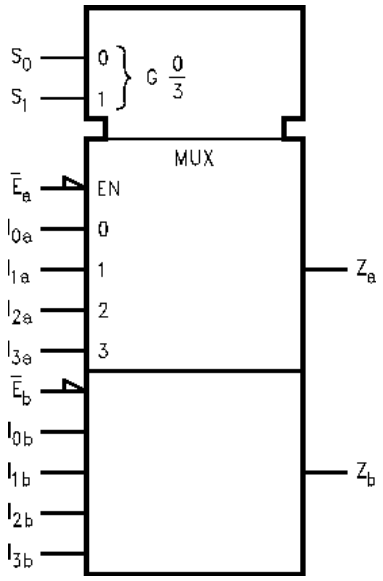
Pin Description

Pin Names	Description
I_{0a}–I_{3a}	Side A Data Inputs
I_{0b}–I_{3b}	Side B Data Inputs
S_0, S_1	Common Select Inputs
$\overline{E}_a$	Side A Enable Input
$\overline{E}_b$	Side B Enable Input
Z_a	Side A Output
Z_b	Side B Output

Logic Symbols



IEEC/IEC



Functional Description

The VHC153 is a dual 4-input multiplexer. It can select two bits of data from up to four sources under the control of the common Select inputs (S_0, S_1). The two 4-input multiplexer circuits have individual active-LOW Enables ($\overline{E}_a$, $\overline{E}_b$) which can be used to strobe the outputs independently. When the Enables ($\overline{E}_a$, $\overline{E}_b$) are HIGH, the corresponding outputs (Z_a, Z_b) are forced LOW. The VHC153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the Select inputs. The logic equations for the outputs are shown below.

$$Z_a = \overline{E}_a \bullet (I_{0a} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1a} \bullet \overline{S}_1 \bullet S_0 + I_{2a} \bullet S_1 \bullet S_0 + I_{3a} \bullet S_1 \bullet S_0)$$

$$Z_b = \overline{E}_b \bullet (I_{0b} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1b} \bullet \overline{S}_1 \bullet S_0 + I_{2b} \bullet S_1 \bullet S_0 + I_{3b} \bullet S_1 \bullet S_0)$$

Truth Table

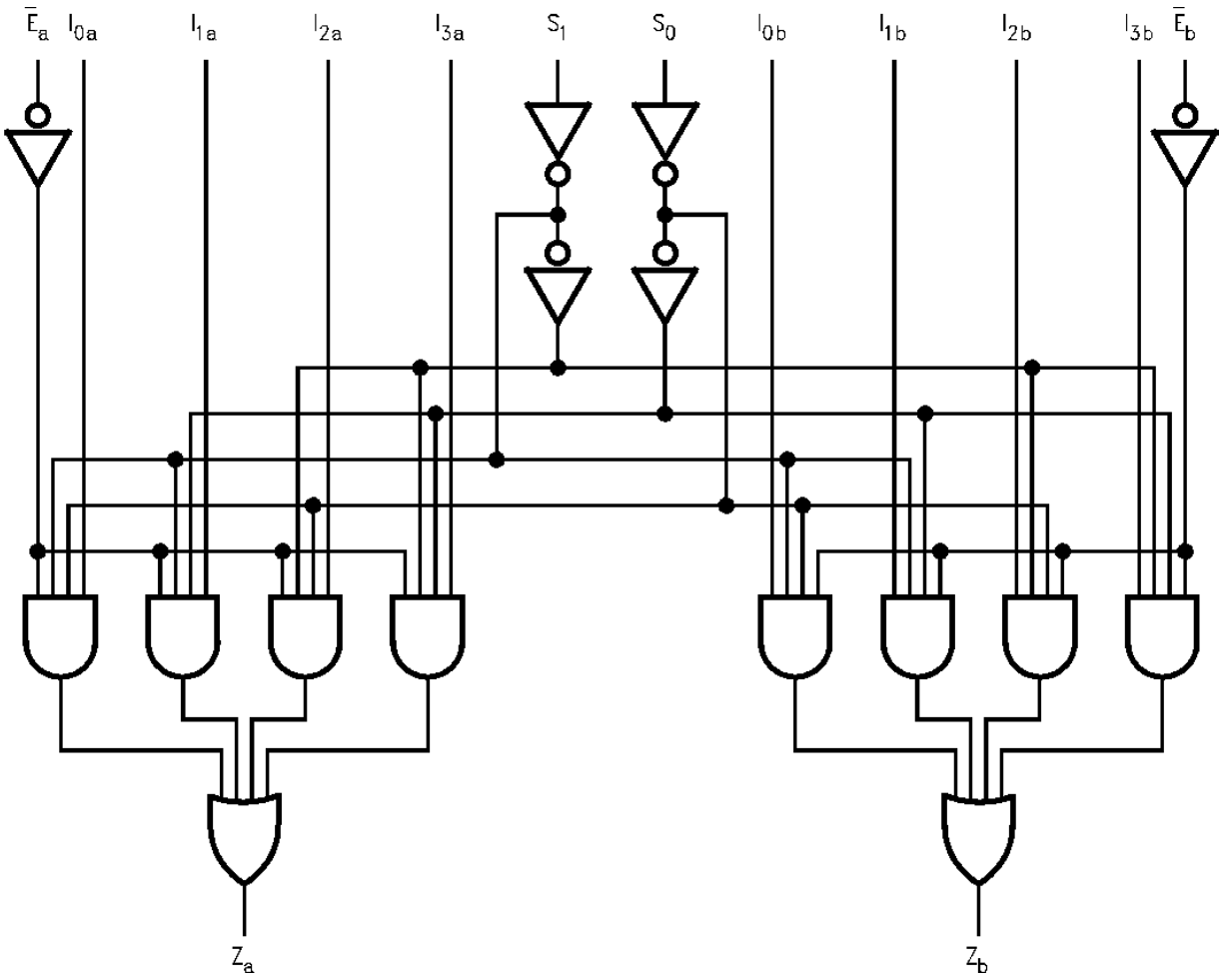
Select Inputs		Inputs (a or b)					Output
S_0	S_1	$\overline{E}$	I_0	I_1	I_2	I_3	Z
X	X	H	X	X	X	X	L
L	L	L	L	X	X	X	L
L	L	L	H	X	X	X	H
H	L	L	X	L	X	X	L
H	L	L	X	H	X	X	H
L	H	L	X	X	L	X	L
L	H	L	X	X	H	X	H
H	H	L	X	X	X	L	L
H	H	L	X	X	X	H	H

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	–0.5V to +7.0V
V_{IN}	DC Input Voltage	–0.5V to +7.0V
V_{OUT}	DC Output Voltage	–0.5V to V_{CC} + 0.5V
I_{IK}	Input Diode Current	–20mA
I_{OK}	Output Diode Current	±20mA
I_{OUT}	DC Output Current	±25mA
I_{CC}	DC V_{CC} / GND Current	±50mA
T_{STG}	Storage Temperature	–65°C to +150°C
T_L	Lead Temperature (Soldering, 10 seconds)	260°C

Recommended Operating Conditions(1)

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	2.0V to +5.5V
V_{IN}	Input Voltage	0V to +5.5V
V_{OUT}	Output Voltage	0V to V_{CC}
T_{OPR}	Operating Temperature	–40°C to +85°C
t_r, t_f	Input Rise and Fall Time,	
	V_{CC} = 3.3V ± 0.3V	0ns/V ~ 100ns/V
	V_{CC} = 5.0V ± 0.5V	0ns/V ~ 20ns/V

Note:

1. Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions		T_A = 25°C			T_A = –40°C to +85°C		Units
					Min.	Typ.	Max.	Min.	Max.	
V_{IH}	HIGH Level Input Voltage	2.0			1.50			1.50		V
		3.0–5.5			0.7 x V_{CC}			0.7 x V_{CC}		
V_{IL}	LOW Level Input Voltage	2.0					0.50		0.50	V
		3.0–5.5					0.3 x V_{CC}		0.3 x V_{CC}	
V_{OH}	HIGH Level Output Voltage	2.0	V_{IN} = V_{IH} or V_{IL}	I_{OH} = –50µA	1.9	2.0		1.9		V
		3.0			2.9	3.0		2.9		
		4.5			4.4	4.5		4.4		
		3.0		I_{OH} = –4mA	2.58			2.48		
		4.5		I_{OH} = –8mA	3.94			3.80		
V_{OL}	LOW Level Output Voltage	2.0	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50µA		0.0	0.1		0.1	V
		3.0				0.0	0.1		0.1	
		4.5				0.0	0.1		0.1	
		3.0		I_{OL} = 4mA			0.36		0.44	
		4.5		I_{OL} = 8mA			0.36		0.44	
I_{IN}	Input Leakage Current	0–5.5	V_{IN} = 5.5V or GND				±0.1		±1.0	µA
I_{CC}	Quiescent Supply Current	5.5	V_{IN} = V_{CC} or GND				4.0		40.0	µA

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C			T_A = –40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
t_{PLH}, t_{PHL}	Propagation Delay, I_n to Z_n	3.3 ± 0.3	C_L = 15pF		7.7	11.9	1.0	14.0	ns
			C_L = 50pF		10.2	15.4	1.0	17.5	
		5.0 ± 0.5	C_L = 15pF		5.0	7.7	1.0	9.0	ns
			C_L = 50pF		6.5	9.7	1.0	11.0	
t_{PLH}, t_{PHL}	Propagation Delay, S_n to Z_n	3.3 ± 0.3	C_L = 15pF		10.8	16.7	1.0	19.5	ns
			C_L = 50pF		13.3	20.2	1.0	23.0	
		5.0 ± 0.5	C_L = 15pF		6.8	9.9	1.0	11.5	ns
			C_L = 50pF		8.3	11.9	1.0	13.5	
t_{PLH}, t_{PHL}	Propagation Delay, $\overline{E}_n$ to Z_n	3.3 ± 0.3	C_L = 15pF		6.3	10.1	1.0	12.0	ns
			C_L = 50pF		8.8	13.6	1.0	15.5	
		5.0 ± 0.5	C_L = 15pF		4.4	6.4	1.0	7.5	ns
			C_L = 50pF		5.9	8.4	1.0	9.5	
C_{IN}	Input Capacitance		V_{CC} = Open		4	10		10	pF
C_{PD}	Power Dissipation Capacitance		(2)		20				pF

Note:

2. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC} (opr.) = C_{PD} • V_{CC} • f_{IN} + I_{CC}

Physical Dimensions

Dimensions are in millimeters unless otherwise noted.

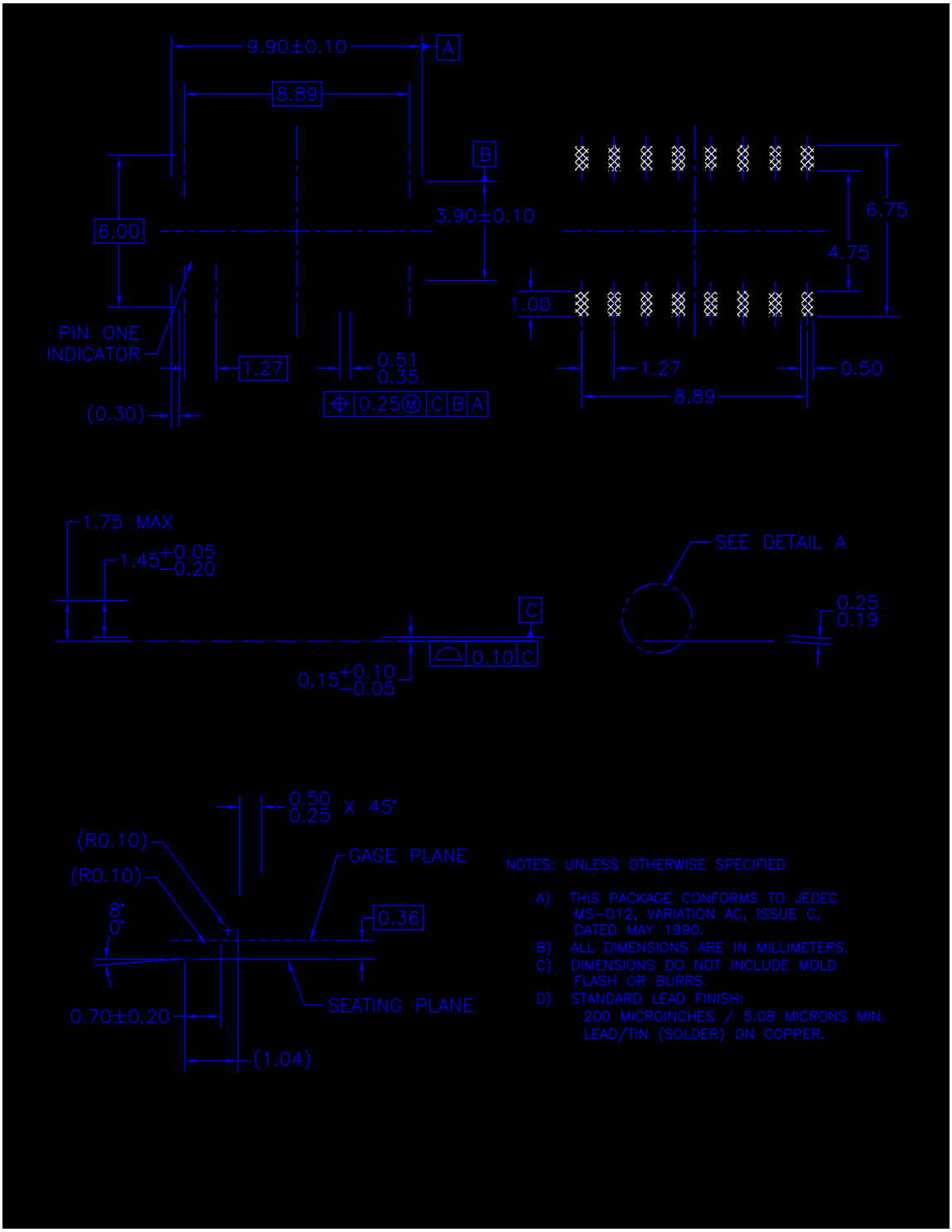


Figure 1. 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

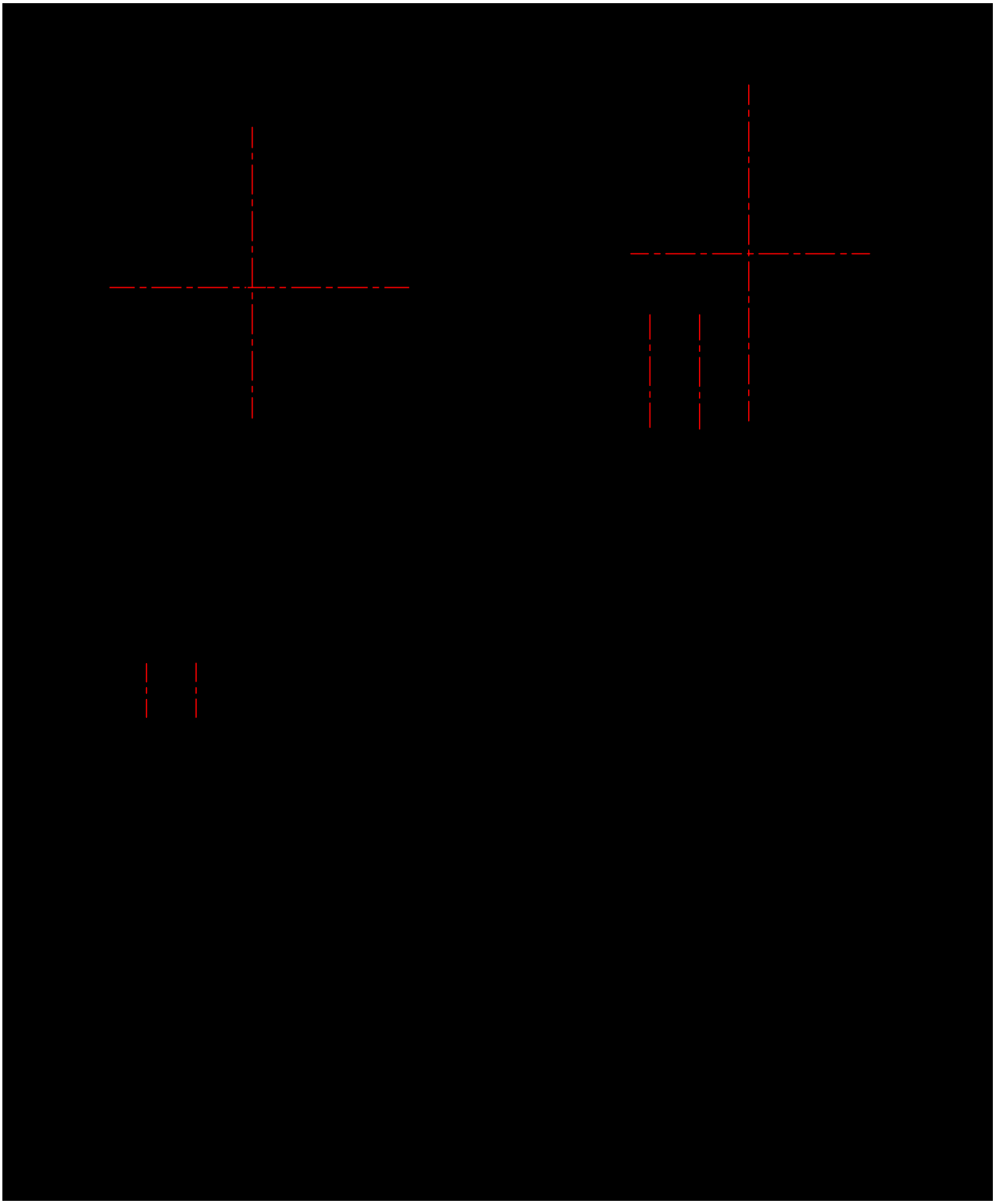


Figure 2. 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

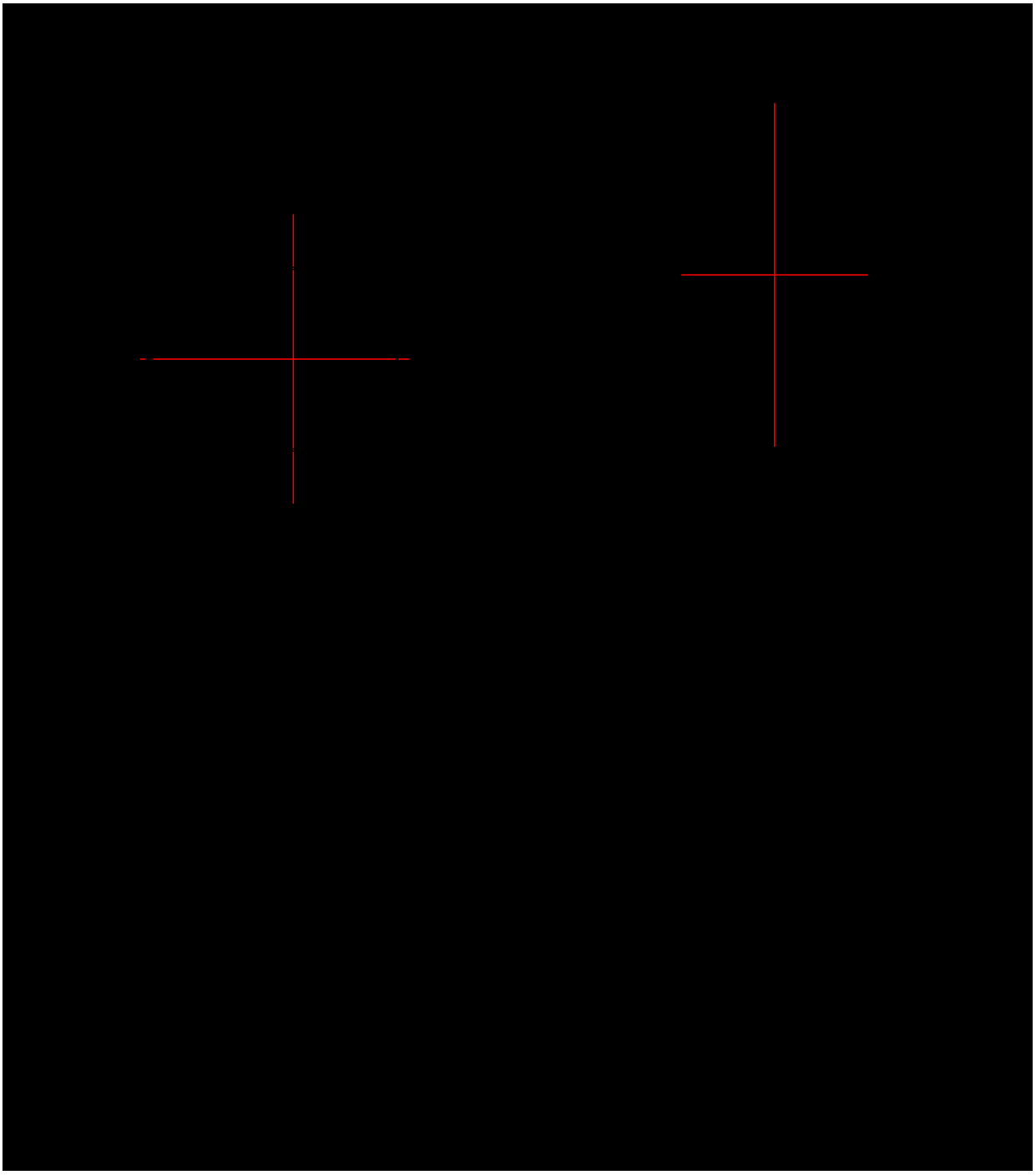


Figure 3. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC16