FAIRCHILD

SEMICONDUCTOR ™

74LVX138
Low Voltage 1-of-8 Decoder/Demultiplexer

General Description

The LVX138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three LVX138 devices or a 1-of-32 decoder using four LVX138 devices and one inverter.

Features

■ Input voltage level translation from 5V to 3V

■ Ideal for low power/low noise 3.3V applications

■ Guaranteed simultaneous switching noise level and dynamic threshold performance

Ordering Code:

Order Number	Package Number	Package Description
74LVX138M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74LVX138SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74LVX138MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Logic Symbols
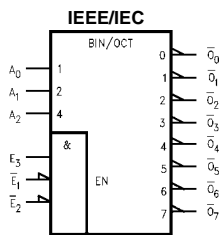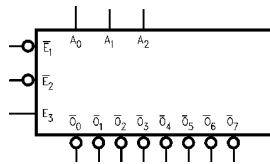
Connection Diagram
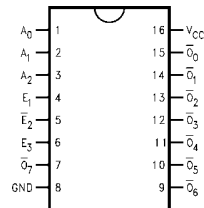
Pin Descriptions

Pin Names	Description
A_0–A_2	Address Inputs
$\overline{E}_1$–$\overline{E}_2$	Enable Inputs
E_3	Enable Input
$\overline{O}_0$–$\overline{O}_7$	Outputs

Functional Description

The LVX138 high-speed 1-of-8 decoder/demultiplexer accepts three binary weighted inputs (A_0, A_1, A_2) and, when enabled, provides eight mutually exclusive active-LOW outputs ($\overline{O}_0$–$\overline{O}_7$). The LVX138 features three Enable inputs, two active-LOW ($\overline{E}_1$, $\overline{E}_2$) and one active-HIGH (E_3).

All outputs will be HIGH unless $\overline{E}_1$ and $\overline{E}_2$ are LOW and E_3 is HIGH.

The LVX138 can be used as an 8-output demultiplexer by using one of the active LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active-HIGH or active-LOW state.

Truth Table

Inputs						Outputs							
$\overline{E}_1$	$\overline{E}_2$	E_3	A_0	A_1	A_2	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$	$\overline{O}_4$	$\overline{O}_5$	$\overline{O}_6$	$\overline{O}_7$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

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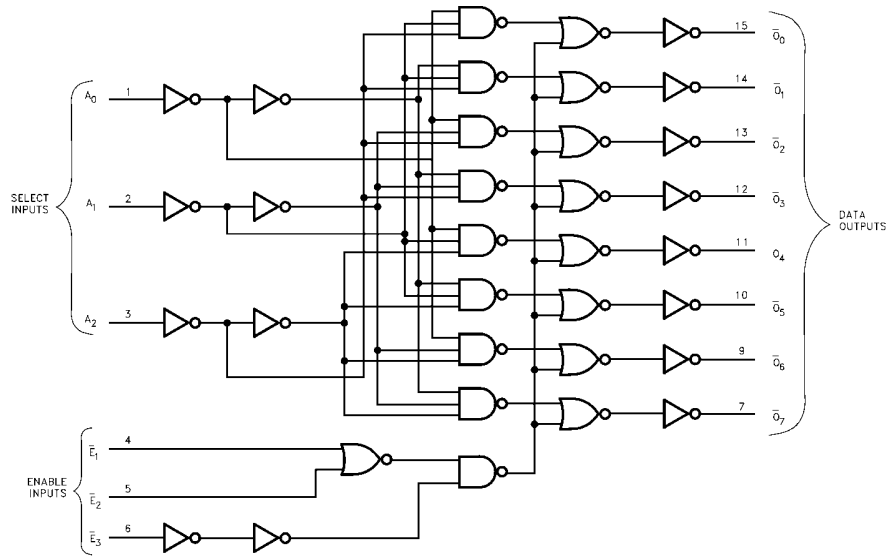
Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Diode Current (I_{IK})	
$V_I = −0.5V$	−20 mA
DC Input Voltage (V_I)	−0.5V to 7V
DC Output Diode Current (I_{OK})	
$V_O = −0.5V$	−20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage (V_O)	−0.5V to V_{CC} + 0.5V
DC Output Source	
or Sink Current (I_O)	±25 mA
DC V_{CC} or Ground Current (I_{CC} or I_{GND})	±75 mA
Storage Temperature (T_{STG})	−65°C to +150°C
Power Dissipation	180 mW

Recommended Operating Conditions (Note 2)

Supply Voltage (V_{CC})	2.0V to 3.6V
Input Voltage (V_I)	0V to 5.5V
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	−40°C to +85°C
Input Rise and Fall Time ($\Delta t/\Delta V$)	0 ns/V to 100 ns/V

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 ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC}	T_A = +25°C			T_A = −40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	HIGH Level	2.0	1.5			1.5				
	Input Voltage	3.0	2.0			2.0		V		
		3.6	2.4			2.4				
V_{IL}	LOW Level	2.0			0.5		0.5			
	Input Voltage	3.0			0.8		0.8	V		
		3.6			0.8		0.8			
V_{OH}	HIGH Level	2.0	1.9	2.0		1.9			$V_{IN} = V_{IL}$ or V_{IH}	$I_{OH} = −50$ μA
	Output Voltage	3.0	2.9	3.0		2.9		V		$I_{OH} = −50$ μA
		3.0	2.58			2.48				$I_{OH} = −4$ mA
V_{OL}	LOW Level	2.0		0.0	0.1		0.1		$V_{IN} = V_{IL}$ or V_{IH}	$I_{OL} = 50$ μA
	Output Voltage	3.0		0.0	0.1		0.1	V		$I_{OL} = 50$ μA
		3.0			0.36		0.44			$I_{OL} = 4$ mA
I_{IN}	Input Leakage Current	3.6			±0.1		±1.0	μA	$V_{IN} = 5.5V$ or GND	
I_{CC}	Quiescent Supply Current	3.6			4.0		40.0	μA	$V_{IN} = V_{CC}$ or GND	

Noise Characteristics (Note 3)

Symbol	Parameter	V_{CC} (V)	T_A = 25°C		Units	C_L (pF)
			Typ	Limit		
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	3.3	0.3	0.5	V	50
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	3.3	−0.3	−0.5	V	50
V_{IHD}	Minimum HIGH Level Dynamic Input Voltage	3.3		2.0	V	50
V_{ILD}	Maximum LOW Level Dynamic Input Voltage	3.3		0.8	V	50

Note 3: Input $t_r = t_f = 3$ ns

AC Electrical Characteristics

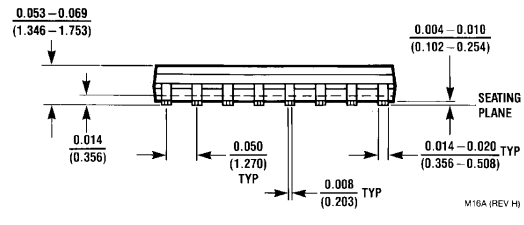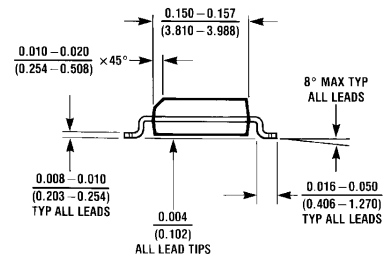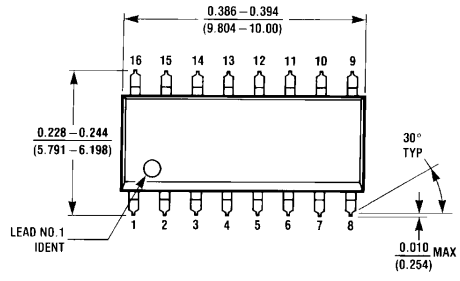| Symbol	Parameter	V_{CC} (V)	$T_A = +25°C$			$T_A = -40°C$ to $+85°C$		Units	CL (pF)
			Min	Typ	Max	Min	Max		
t_{PLH}	Propagation	2.7		7.1	13.8	1.0	16.5	ns	15
t_{PHL}	Delay Time			9.6	17.3	1.0	20.0		50
	A_n to $\overline{O}_n$	3.3 ± 0.3		5.5	8.8	1.0	10.5		15
				8.0	12.3	1.0	14.0		50
t_{PLH}	Propagation	2.7		8.8	16.0	1.0	18.5	ns	15
t_{PHL}	Delay Time			11.3	19.5	1.0	22.0		50
	$\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$	3.3 ± 0.3		6.9	10.4	1.0	11.5		15
				9.4	13.9	1.0	15.0		50
t_{PLH}	Propagation	2.7		8.7	16.3	1.0	19.5	ns	15
t_{PHL}	Delay Time			11.2	19.8	1.0	23.0		50
	E_3 to $\overline{O}_n$	3.3 ± 0.3		6.8	10.6	1.0	12.5		15
				9.3	14.1	1.0	16.0		50
t_{OSHL}	Output to Output	2.7			1.5		1.5	ns	50
t_{OSLH}	Skew (Note 4)	3.3			1.5		1.5		

Note 4: Parameter guaranteed by design. $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$, $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$

Capacitance

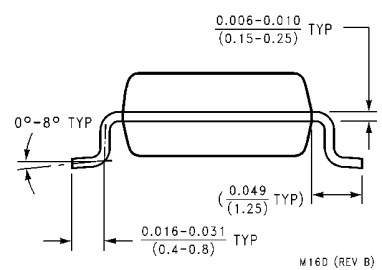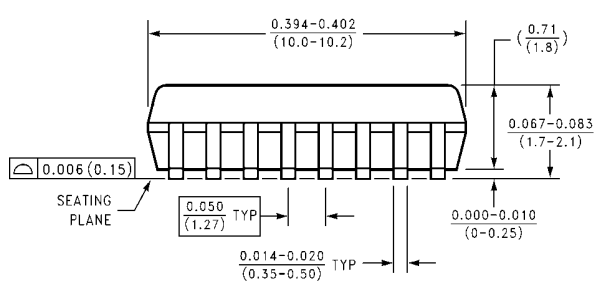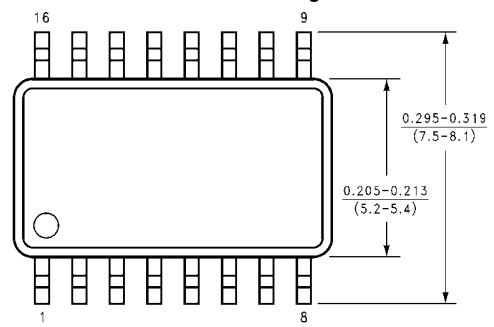| Symbol	Parameter	$T_A = +25°C$			$T_A = -40°C$ to $+85°C$		Units
		Min	Typ	Max	Min	Max	
C_{IN}	Input Capacitance		4	10		10	pF
C_{PD}	Power Dissipation Capacitance (Note 5)		34				pF

Note 5: 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: $C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$

Physical Dimensions inches (millimeters) unless otherwise noted

0.386 − 0.394
(9.804 − 10.00)

16 15 14 13 12 11 10 9

0.228 − 0.244
(5.791 − 6.198)

30°
TYP

LEAD NO.1
IDENT

1 2 3 4 5 6 7 8

0.010
(0.254) MAX

0.150 − 0.157
(3.810 − 3.988)

0.010 − 0.020
(0.254 − 0.508) × 45°

8° MAX TYP
ALL LEADS

0.008 − 0.010
(0.203 − 0.254)
TYP ALL LEADS

0.004
(0.102)
ALL LEAD TIPS

0.016 − 0.050
(0.406 − 1.270)
TYP ALL LEADS

0.053 − 0.069
(1.346 − 1.753)

0.004 − 0.010
(0.102 − 0.254)

SEATING
PLANE

0.014
(0.356)

0.050
(1.270)
TYP

0.008
(0.203) TYP

0.014 − 0.020
(0.356 − 0.508) TYP

M16A (REV H)

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

16   9

0.295 − 0.319
(7.5 − 8.1)

0.205 − 0.213
(5.2 − 5.4)

1   8

0.394 − 0.402
(10.0 − 10.2)

(0.71)
(1.8)

0.006 − 0.010
(0.15 − 0.25) TYP

0.067 − 0.083
(1.7 − 2.1)

0° − 8° TYP

0.006 (0.15)

SEATING
PLANE

0.050
(1.27) TYP

0.000 − 0.010
(0 − 0.25)

0.049
(1.25) TYP

0.014 − 0.020
(0.35 − 0.50) TYP

0.016 − 0.031
(0.4 − 0.8) TYP

M16D (REV B)

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

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

DIMENSIONS METRIC ONLY

7.72 TYP.
4.16 TYP.

(1.78 TYP)

0.42 TYP
0.65 TYP

LAND PATTERN RECOMMENDATION

5.0 ± 0.1
−A−

16   9

6.4

4.4 ± 0.1
−B−

3.2

1   8

PIN # 1 IDENT.

⌀ 0.2 C B A
ALL LEAD TIPS

GAGE PLANE
0.25

SEATING PLANE
0°−8°
0.6 ± 0.1

DETAIL A
TYPICAL, SCALE: 40X

⌀ 0.1 C
ALL LEAD TIPS

−C−

(0.90)
1.1 MAX TYP

0.65 TYP

0.10 ± 0.05 TYP

0.19 − 0.30 TYP

⊕ 0.13 Ⓜ A B Ⓢ C Ⓢ

SEE DETAIL A

0.09−0.20 TYP

MTC16 (REV C)

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