

74LCX138

Low Voltage 1-of-8 Decoder/Demultiplexer with 5V Tolerant Inputs

General Description

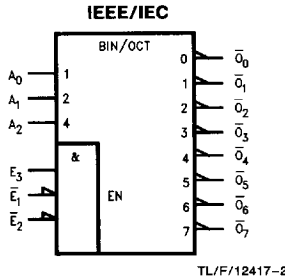
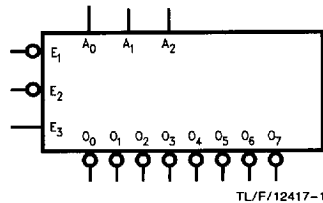
The LCX138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three LCX138 devices or a 1-of-32 decoder using four LCX138 devices and one inverter.

The 74LCX138 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

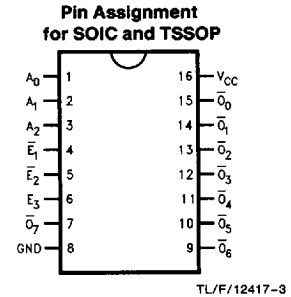
Features

- 5V tolerant inputs
- 6.0 ns t_{PD} max, 10 μ A I_{CCQ} max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal
- 2.0V–3.6V V_{CC} supply operation
- ± 24 mA output drive
- Implements patented Quiet Series™ noise/EMI reduction circuitry
- Functionally compatible with 74 series 138
- Latch-up performance exceeds 500 mA
- ESD performance:
 - Human body model > 2000V
 - Machine model > 200V

Logic Symbols



Connection Diagram



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

	SOIC JEDEC	SOIC EIAJ	TSSOP
Order Number	74LCX138M 74LCX138MX	74LCX138SJ 74LCX138SJX	74LCX138MTC 74LCX138MTCX
See NS Package Number	M16A	M16D	MTC16

Functional Description

The LCX138 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 (\bar{O}_0 – \bar{O}_7). The LCX138 features three Enable inputs, two active-LOW (\bar{E}_1 , \bar{E}_2) and one active-HIGH (E_3). All outputs will be HIGH unless \bar{E}_1 and \bar{E}_2 are LOW and E_3 is HIGH.

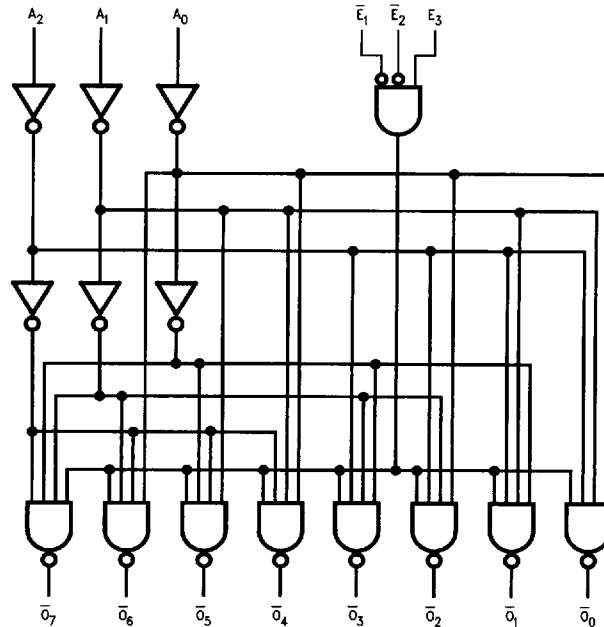
The LCX138 can be used as an 8-output demultiplexer by using one of the active LOW Enable inputs as the data input and the other Enable inputs as strobes. The Enable inputs which are not used must be permanently tied to their appropriate active-HIGH or active-LOW state.

Truth Table

Inputs						Outputs							
\bar{E}_1	\bar{E}_2	E_3	A_0	A_1	A_2	\bar{O}_0	\bar{O}_1	\bar{O}_2	\bar{O}_3	\bar{O}_4	\bar{O}_5	\bar{O}_6	\bar{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



TL/F/12417-4

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)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Symbol	Parameter	Value	Conditions	Units
V _{CC}	Supply Voltage	-0.5 to +7.0		V
V _I	DC Input Voltage	-0.5 to +7.0		V
V _O	DC Output Voltage	-0.5 to V _{CC} + 0.5	Output in High or Low State (Note 2)	V
I _{IK}	DC Input Diode Current	-50	V _I < GND	mA
I _{OK}	DC Output Diode Current	-50 +50	V _O < GND V _O > V _{CC}	mA
I _O	DC Output Source/Sink Current	±50		mA
I _{CC}	DC Supply Current per Supply Pin	±100		mA
I _{GND}	DC Ground Current per Ground Pin	±100		mA
T _{STG}	Storage Temperature	-65 to +150		°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" table are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2: I_O Absolute Maximum Rating must be observed.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units	
V _{CC}	Supply Voltage	Operating Data Retention	2.0 1.5	3.6 3.6	V
V _I	Input Voltage	0	5.5	V	
V _O	Output Voltage	HIGH or LOW State	0	V _{CC}	V
I _{OH} /I _{OL}	Output Current	V _{CC} = 3.0V-3.6V V _{CC} = 2.7V		±24 ±12	mA
T _A	Free-Air Operating Temperature	-40	85	°C	
ΔV/ΔV	Input Edge Rate, V _{IN} = 0.8V-2.0V, V _{CC} = 3.0V	0	10	ns/V	

DC Electrical Characteristics

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = -40°C to +85°C		Units
				Min	Max	
V _{IH}	HIGH Level Input Voltage		2.7-3.6	2.0		V
V _{IL}	LOW Level Input Voltage		2.7-3.6		0.8	V
V _{OH}	HIGH Level Output Voltage	I _{OH} = -100 μA	2.7-3.6	V _{CC} - 0.2		V
		I _{OH} = -12 mA	2.7	2.2		V
		I _{OH} = -18 mA	3.0	2.4		V
		I _{OH} = -24 mA	3.0	2.2		V
V _{OL}	LOW Level Output Voltage	I _{OL} = 100 μA	2.7-3.6		0.2	V
		I _{OL} = 12 mA	2.7		0.4	V
		I _{OL} = 16 mA	3.0		0.4	V
		I _{OL} = 24 mA	3.0		0.55	V
I _I	Input Leakage Current	0 ≤ V _I ≤ 5.5V	2.7-3.6		±5.0	μA
I _{OFF}	Power-Off Leakage Current	V _I or V _O = 5.5V	0		10	μA
I _{CC}	Quiescent Supply Current	V _I = V _{CC} or GND	2.7-3.6		10	μA
		3.6V ≤ V _I , V _O ≤ 5.5V	2.7-3.6		±10	μA
ΔI _{CC}	Increase in I _{CC} per Input	V _{IH} = V _{CC} - 0.6V	2.7-3.6		500	μA

AC Electrical Characteristics (Preliminary)

Symbol	Parameter	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$				Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		
		Min	Max	Min	Max	
t_{PHL} t_{PLH}	Propagation Delay A_n to \bar{Y}_n	1.5 1.5	6.0 6.0	1.5 1.5	7.0 7.0	ns
t_{PHL} t_{PLH}	Propagation Delay E_3 to \bar{Y}_n	1.5 1.5	6.5 6.5	1.5 1.5	7.5 7.5	ns
t_{PHL} t_{PLH}	Propagation Delay \bar{E}_1 or \bar{E}_2 to \bar{Y}_n	1.5 1.5	6.0 6.0	1.5 1.5	7.0 7.0	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 3)		1.0 1.0			ns

Note 3: Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH to LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}).

Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25^{\circ}\text{C}$	Units
				Typical	
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	$C_L = 50\text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	$C_L = 50\text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$	3.3	0.8	V

Capacitance

Symbol	Parameter	Conditions	Typical	Units
C_{IN}	Input Capacitance	$V_{CC} = \text{Open}, V_I = 0V \text{ or } V_{CC}$	7	pF
C_{OUT}	Output Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}$	8	pF
C_{PD}	Power Dissipation Capacitance	$V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}, F = 10\text{ MHz}$	25	pF