

Low Voltage 1-of-8 Decoder/Demultiplexer

With 5 V Tolerant Inputs

74LCX138

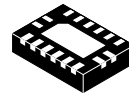
The LCX138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three LCX138 devices or a 1-of-32 decoder using four LCX138 devices and one inverter.

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

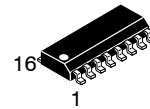
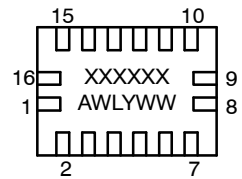
Features

- 5 V Tolerant Inputs
- 1.65 V to 5.5 V V_{CC} Specifications Provided
- 6.0 ns t_{PD} Max ($V_{CC} = 3.3$ V), 10 μ A I_{CC} Max
- Power Down High Impedance Inputs and Outputs
- ± 24 mA Output Drive ($V_{CC} = 3.0$ V)
- Implements Patented Noise/EMI Reduction Circuitry
- Latch-up Performance Exceeds 100 mA
- ESD Performance: Human Body Model >2000 V
- These are Pb-Free Devices

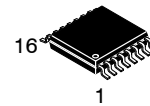
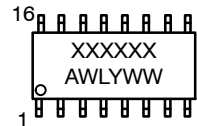
MARKING DIAGRAMS



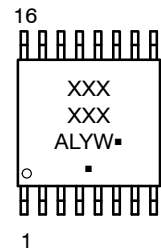
WQFN16 3.5x2.5, 0.5P
CASE 510CC



SOIC-16, 150 mils
CASE 751BG



TSSOP-16
CASE 948AH



A = Assembly Location
WL, L = Wafer Lot
Y = Year
WW, W = Work Week
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

Connection Diagrams

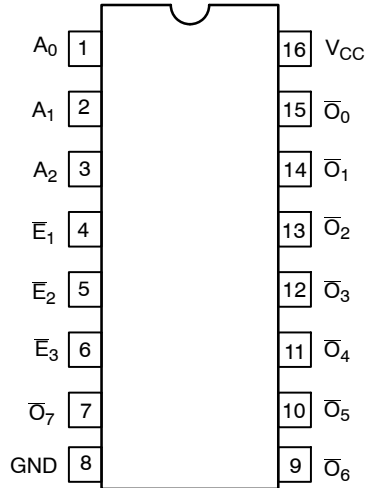


Figure 1. Pin Assignment for SOIC, SOP, and TSSOP

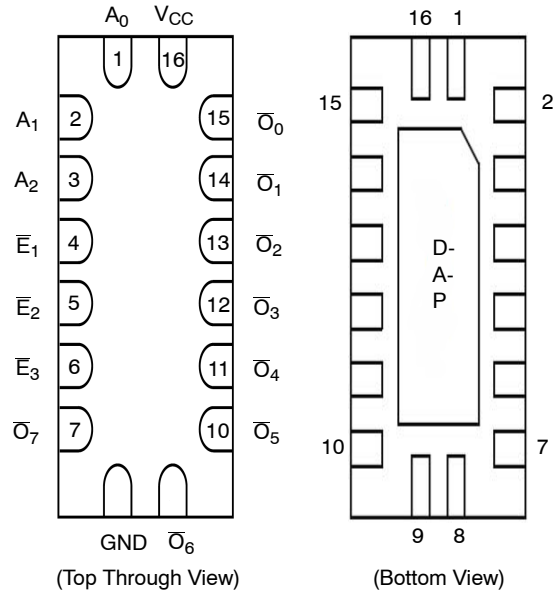


Figure 2. Pad Assignment for WQFN

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
DAP	No Connect

NOTE: DAP (Die Attach Pad)

Functional Description

The LCX138 high-speed 1-of-8 decoder/demultiplexer accepts three binary weighted inputs (A₀, A₁, A₂) and, when enabled, provides eight mutually exclusive active-LOW outputs (O₀–O₇). The LCX138 features three Enable inputs, two active-LOW ($\overline{E}_1$, $\overline{E}_2$) and one active-HIGH (E₃). All outputs will be HIGH unless $\overline{E}_1$ and $\overline{E}_2$ are LOW and E₃ 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							
$\overline{E}_1$	$\overline{E}_2$	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

74LCX138

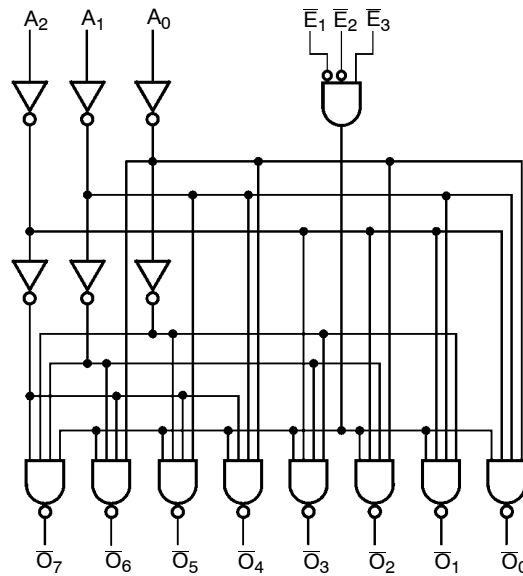


Figure 3. Logic Diagram

NOTE: 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

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	-0.5 to +6.5	V
V_I	DC Input Voltage (Note 1)	-0.5 to +6.5	V
V_O	DC Output Voltage (Note 1) Active-Mode (High or Low State) Tri-State Mode Power-Down Mode ($V_{CC} = 0$ V)	-0.5 to $V_{CC} + 0.5$ -0.5 to +6.5 -0.5 to +6.5	V
I_{IK}	DC Input Diode Current $V_I < GND$	-50	mA
I_{OK}	DC Output Diode Current $V_O < GND$	-50	mA
I_O	DC Output Source/Sink Current	± 50	mA
I_{CC} or I_{GND}	DC Supply Current per Supply Pin or Ground Pin	± 100	mA
T_{STG}	Storage Temperature Range	-65 to +150	$^{\circ}C$
T_L	Lead Temperature, 1 mm from Case for 10 secs	260	$^{\circ}C$
T_J	Junction Temperature Under Bias	+150	$^{\circ}C$
θ_{JA}	Thermal Resistance (Note 1) SOIC-16 WQFN-16 TSSOP-16	126 114 159	$^{\circ}C/W$
P_D	Power Dissipation in Still Air at 125 $^{\circ}C$ SOIC-16 WQFN-16 TSSOP-16	995 1094 787	mW
MSL	Moisture Sensitivity	Level 1	-
F_R	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V_{ESD}	ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model	2000 N/A	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- I_O absolute maximum rating must be observed.
- Measured with minimum pad spacing on an FR4 board, using 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
- HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit
V_{CC}	Supply Voltage Operating Data Retention Only	1.65 1.5	3.3 3.3	5.5 5.5	V
V_I	Digital Input Voltage	0	–	5.5	V
V_O	Output Voltage Active Mode (High or Low State) Tri-State Mode Power Down Mode ($V_{CC} = 0$ V)	0 0 0	– – –	V_{CC} 5.5 5.5	V
T_A	Operating Free-Air Temperature	–40	–	+125	°C
t_r, t_f	Input Rise or Fall Rate $V_{CC} = 1.65$ V to 1.95 V $V_{CC} = 2.3$ V to 2.7 V V_{IN} from 0.8 V to 2.0 V, $V_{CC} = 3.0$ V $V_{CC} = 4.5$ V to 5.5 V	0 0 0 0	– – – –	20 20 10 5	nS/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

4. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		$T_A = -40^\circ\text{C to } +125^\circ\text{C}$		Unit
				Min	Max	Min	Max	
V_{IH}	HIGH Level Input Voltage		1.65 – 1.95	$0.65 \times V_{CC}$	–	$0.65 \times V_{CC}$	–	V
			2.3 – 2.7	1.7	–	1.7	–	
			3.0 – 3.6	2.0	–	2.0	–	
			4.5 – 5.5	$0.70 \times V_{CC}$	–	$0.70 \times V_{CC}$	–	
V_{IL}	LOW Level Input Voltage		1.65 – 1.95	–	$0.35 \times V_{CC}$	–	$0.35 \times V_{CC}$	V
			2.3 – 2.7	–	0.7	–	0.7	
			3.0 – 3.6	–	0.8	–	0.8	
			4.5 – 5.5	–	$0.30 \times V_{CC}$	–	$0.30 \times V_{CC}$	
V_{OH}	High-Level Output Voltage	$V_I = V_{IH}$ or V_{IL} $I_{OH} = -100 \mu\text{A}$ $I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -16 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -32 \text{ mA}$	1.65 – 5.5 1.65 2.3 2.7 3.0 3.0 4.5	$V_{CC} - 0.1$ 1.29 1.8 2.2 2.4 2.2 3.7	– – – – – – –	$V_{CC} - 0.1$ 1.29 1.8 2.2 2.4 2.2 3.7	– – – – – – –	V
V_{OL}	Low-Level Output Voltage	$V_I = V_{IH}$ or V_{IL} $I_{OL} = 100 \mu\text{A}$ $I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 16 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 32 \text{ mA}$	1.65 – 5.5 1.65 2.3 2.7 3.0 3.0 4.5	– – – – – – –	0.1 0.24 0.3 0.4 0.4 0.55 0.6	– – – – – – –	0.1 0.24 0.3 0.4 0.4 0.55 0.6	V
I_I	Input Leakage Current	$V_I = 0$ to 5.5 V	1.65 – 5.5	–	± 5.0	–	± 5.0	μA
I_{OFF}	Power Off Leakage Current	$V_I = 5.5$ V or $V_O = 5.5$ V	0	–	10	–	10	μA
I_{CC}	Quiescent Supply Current	$V_I = 5.5$ V or GND	1.65 – 5.5	–	10	–	10	μA
ΔI_{CC}	Increase in I_{CC} per Input	$V_{IH} = V_{CC} - 0.6$ V	2.3 – 3.6	–	500	–	500	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.



74LCX138

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition	V _{CC} (V)	T _A = -40°C to +85°C		T _A = -40°C to +125°C		Unit
				Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, A _n to $\overline{O_n}$	See Figures 4 and 5	1.65 to 1.95	–	11.5	–	11.5	ns
			2.3 to 2.7	–	7.2	–	7.2	
			2.7	–	7.0	–	7.0	
			3.0 to 3.6	–	6.0	–	6.0	
			4.5 to 5.5	–	5.0	–	5.0	
t _{PLH} , t _{PHL}	Propagation Delay, E ₁ , E ₂ to $\overline{O_n}$	See Figures 4 and 5	1.65 to 1.95	–	12.0	–	12.0	ns
			2.3 to 2.7	–	8.4	–	8.4	
			2.7	–	7.5	–	7.5	
			3.0 to 3.6	–	6.5	–	6.5	
			4.5 to 5.5	–	5.5	–	5.5	
t _{PLH} , t _{PHL}	Propagation Delay, E ₃ to $\overline{O_n}$	See Figures 4 and 5	1.65 to 1.95	–	11.5	–	11.5	ns
			2.3 to 2.7	–	7.2	–	7.2	
			2.7	–	7.0	–	7.0	
			3.0 to 3.6	–	6.0	–	6.0	
			4.5 to 5.5	–	5.0	–	5.0	
t _{OSHL} , t _{OSLH}	Output to Output Skew (Note 5)		1.65 to 1.95	–	–	–	–	ns
			2.3 to 2.7	–	–	–	–	
			2.7	–	–	–	–	
			3.0 to 3.6	–	1.0	–	1.0	
			4.5 to 5.5	–	–	–	–	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

5. 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}). Parameter guaranteed by design.

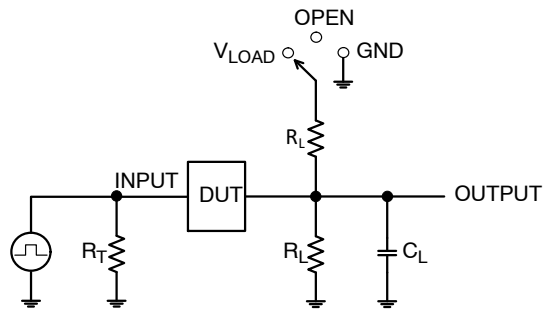
DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C	Unit
				Typical	
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
		C _L = 30 pF, V _{IH} = 2.5 V, V _{IL} = 0 V	2.5	0.6	
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	–0.8	V
		C _L = 30 pF, V _{IH} = 2.5 V, V _{IL} = 0 V	2.5	–0.6	

CAPACITANCE

Symbol	Parameter	Condition	Typical	Units
C _{IN}	Input Capacitance	V _{CC} = Open, V _I = 0 V or V _{CC}	7.0	pF
C _{OUT}	Output Capacitance	V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	8.0	pF
C _{PD}	Power Dissipation Capacitance	V _{CC} = 3.3 V, V _I = 0 V or V _{CC} , f = 10 MHz	25.0	pF

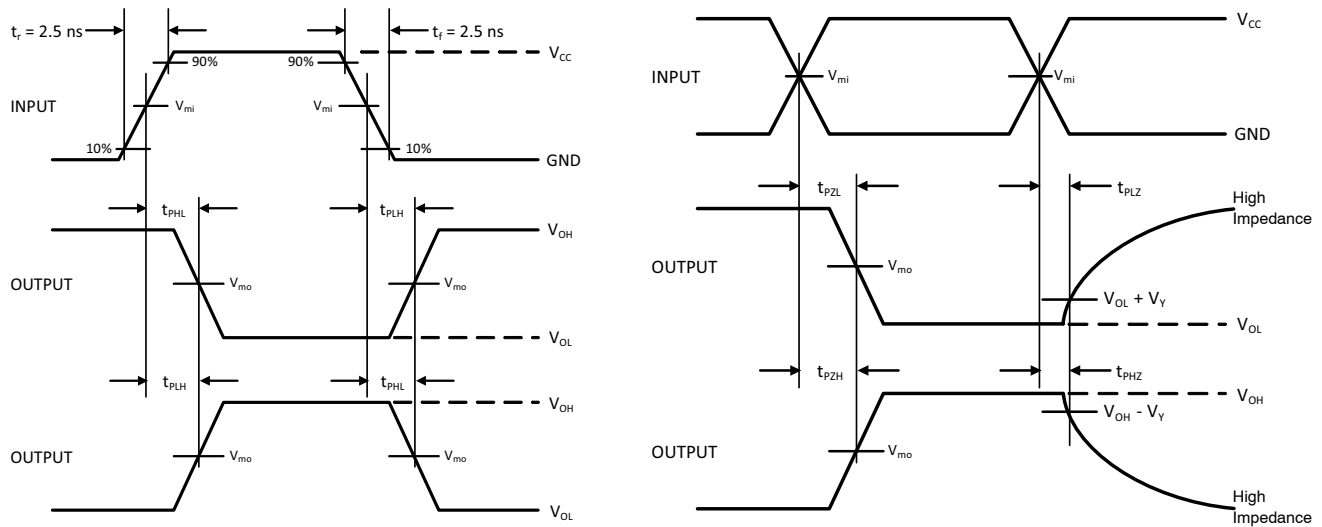
74LCX138



C_L includes probe and jig capacitance
 R_T is Z_{OUT} of pulse generator (typically 50 Ω)
 $f = 1$ MHz

Test	Switch Position
t_{PLH} / t_{PHL}	Open
t_{PLZ} / t_{PZL}	V_{LOAD}
t_{PHZ} / t_{PZH}	GND

Figure 4. Test Circuit



V_{CC}, V	R_L, Ω	C_L, pF	V_{LOAD}	V_m, V	V_Y, V
1.65 to 1.95	500	30	$2 \times V_{CC}$	$V_{CC}/2$	0.15
2.3 to 2.7	500	30	$2 \times V_{CC}$	$V_{CC}/2$	0.15
2.7	500	50	6 V	1.5	0.3
3.0 to 3.6	500	50	6 V	1.5	0.3
4.5 to 5.5	500	50	$2 \times V_{CC}$	$V_{CC}/2$	0.3

Figure 5. Switching Waveforms

74LCX138

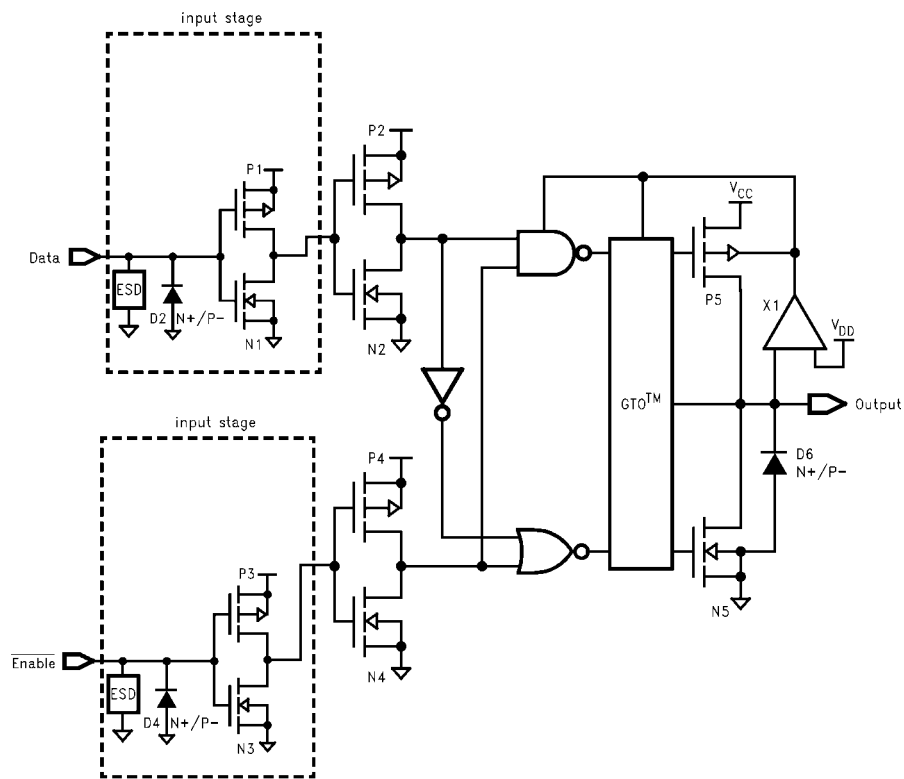


Figure 6. Schematic Diagram (Generic for LCX Family)

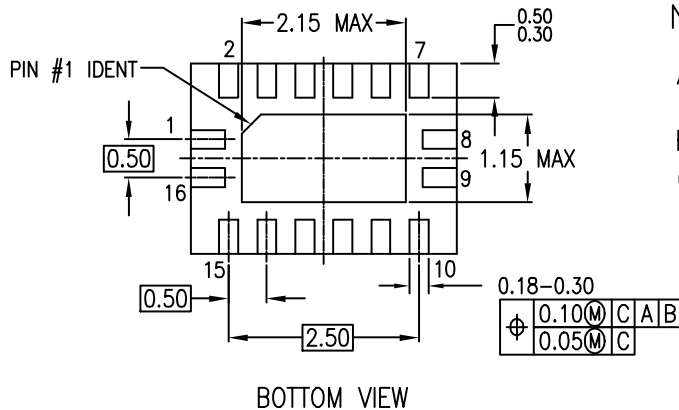
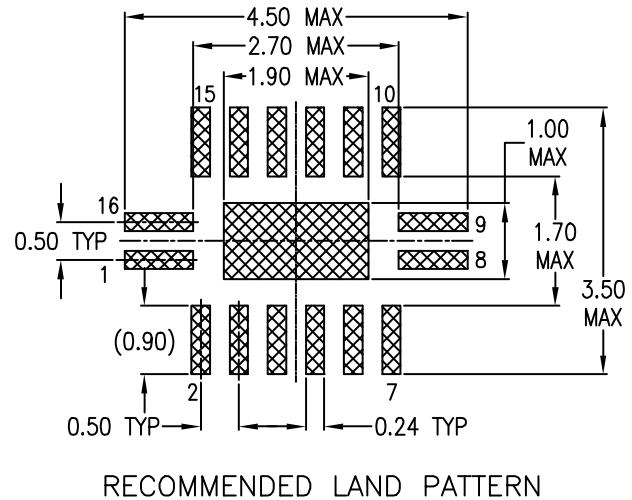
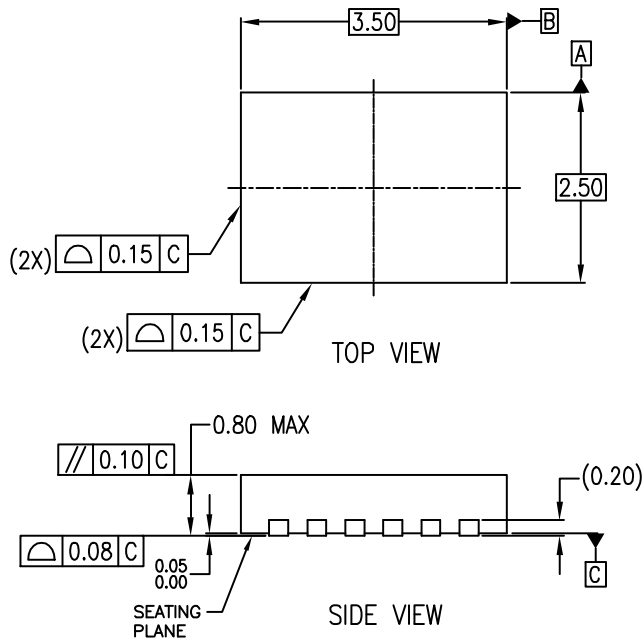
ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
74LCX138BQX	LCX138	WQFN-16 (Pb-Free)	3000 Units / Tape & Reel
74LCX138MX	LCX138	SOIC-16 (Pb-Free)	2500 Units / Tape & Reel
74LCX138MTCX	LCX 138	TSSOP-16 (Pb-Free)	2500 Units / Tape & Reel

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

WQFN16 3.5x2.5, 0.5P
CASE 510CC
ISSUE O

DATE 31 AUG 2016



NOTES:

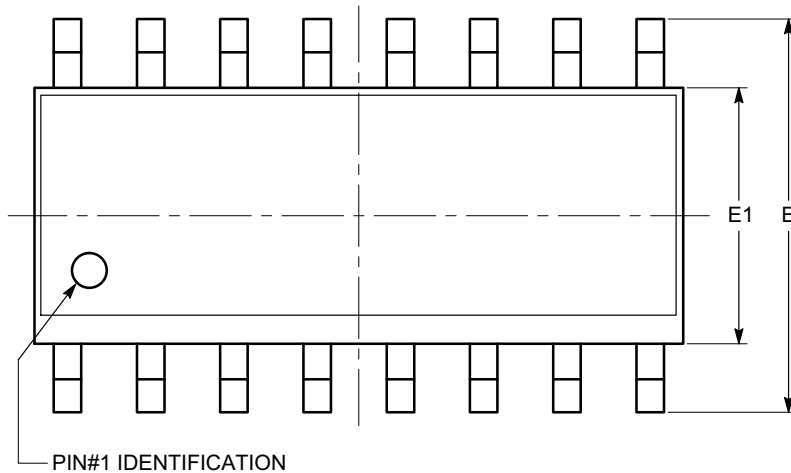
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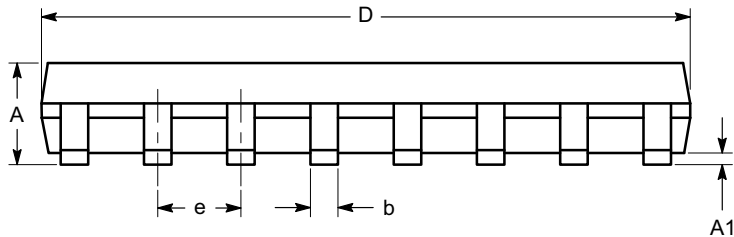
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CASE 751BG
ISSUE O

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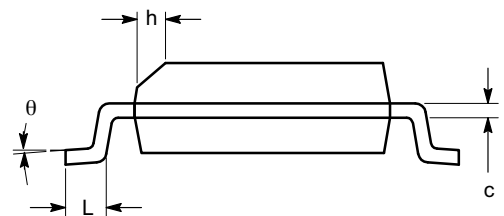


SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25		0.50
L	0.40		1.27
θ	0°		8°

TOP VIEW



SIDE VIEW



END VIEW

Notes:

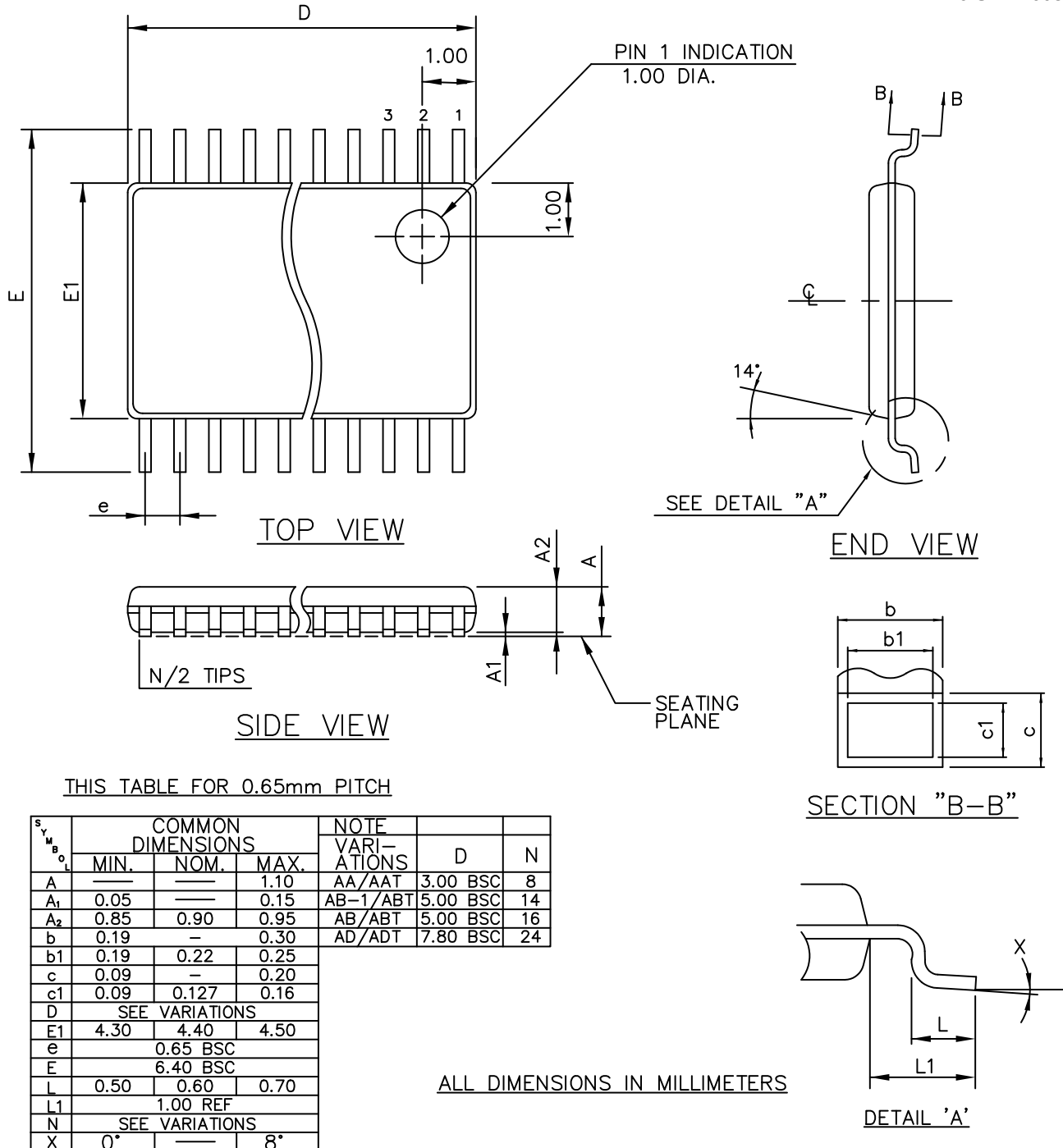
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- (2) Complies with JEDEC MS-012.

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