

TC74LVX138F, TC74LVX138FN, TC74LVX138FT

3-to-8 Line Decoder

The TC74LVX138F/ FN/ FT is a high-speed CMOS 3-to-8 line decoder fabricated with silicon gate CMOS technology. Designed for use in 3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

This device is suitable for low-voltage and battery operated systems.

When the device is enabled, 3 Binary Select inputs (A, B and C) determine which one of the outputs ($\overline{Y}0-\overline{Y}7$) will go low. When enable input G1 is held low or either $\overline{G}2A$ or $\overline{G}2B$ is held high, decoding function is inhibited and all outputs go high.

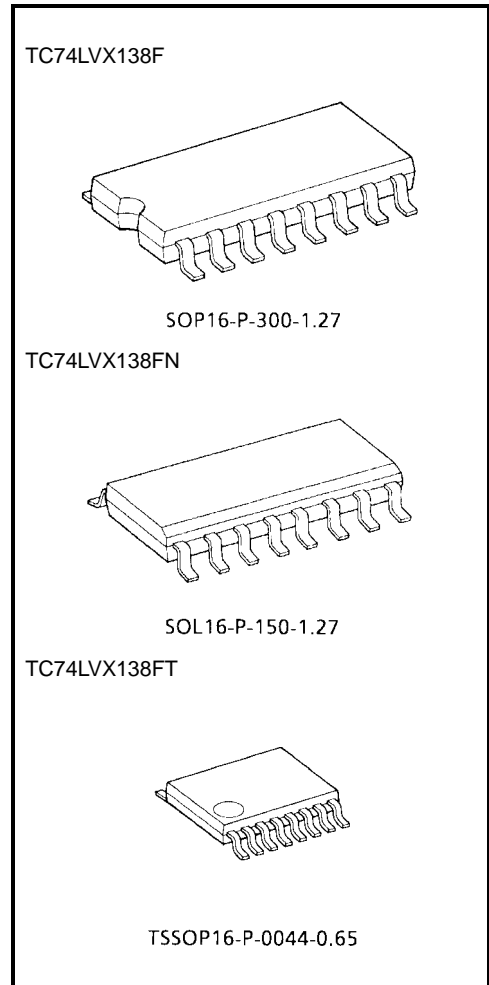
G1, $\overline{G}2A$, and $\overline{G}2B$ inputs are provided to ease cascade connection and for use as an address decoder for memory systems.

An input protection circuit ensures that 0 to 5.5V 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 back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

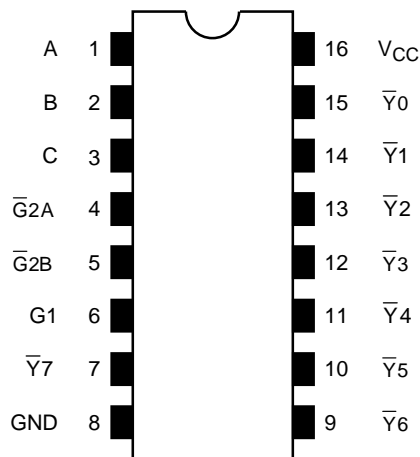
- High-speed: $t_{pd} = 5.5 \text{ ns (typ.) (VCC = 3.3 V)}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A (max) (Ta = 25}^\circ\text{C)}$
- Input voltage level: $V_{IL} = 0.8 \text{ V (max) (VCC = 3 V)}$
 $V_{IH} = 2.0 \text{ V (min) (VCC = 3 V)}$
- Power-down protection provided on all inputs
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74HC138

Note: xxxFN (JEDEC SOP) is not available in Japan.

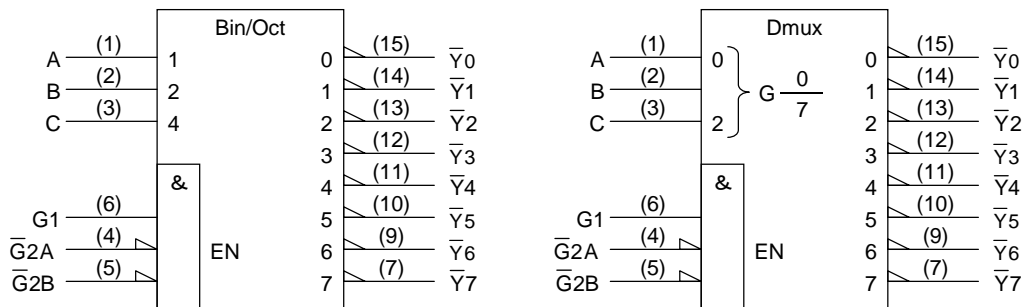


Weight
 SOP16-P-300-1.27: 0.18 g (typ.)
 SOL16-P-150-1.27: 0.12 g (typ.)
 TSSOP16-P-0044-0.65: 0.06 g (typ.)

Pin Assignment (top view)



IEC Logic Symbol

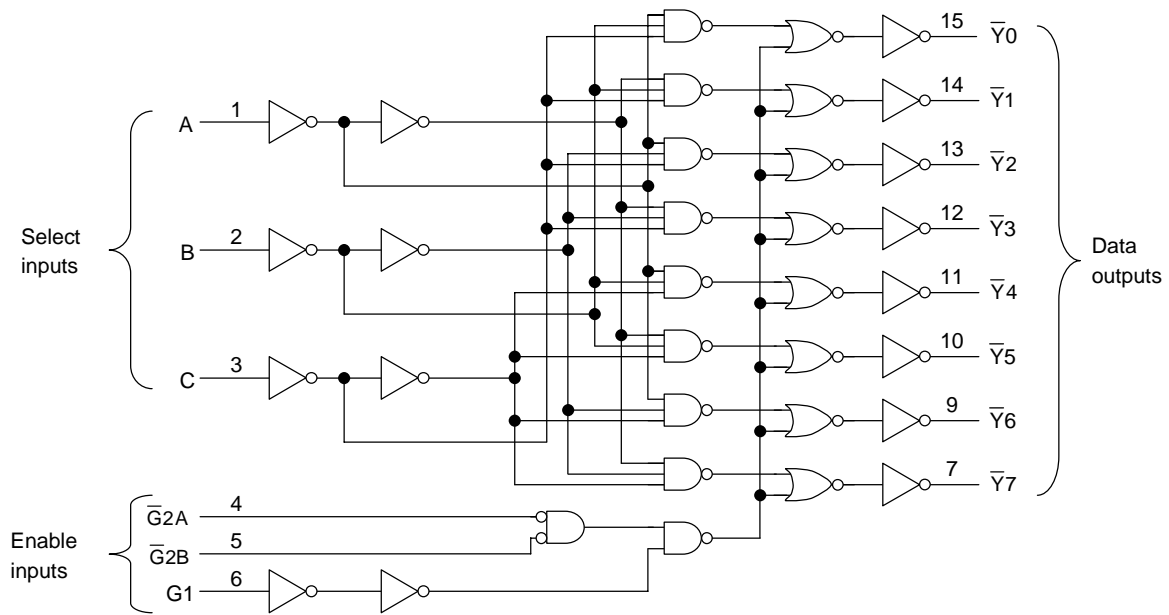


Truth Table

Inputs						Outputs								Selected Output
Enable			Select			$\bar{Y}0$	$\bar{Y}1$	$\bar{Y}2$	$\bar{Y}3$	$\bar{Y}4$	$\bar{Y}5$	$\bar{Y}6$	$\bar{Y}7$	
G1	$\bar{G}2A$	$\bar{G}2B$	C	B	A									
L	X	X	X	X	X	H	H	H	H	H	H	H	H	None
X	H	X	X	X	X	H	H	H	H	H	H	H	H	None
X	X	H	X	X	X	H	H	H	H	H	H	H	H	None
H	L	L	L	L	L	L	H	H	H	H	H	H	H	$\bar{Y}0$
H	L	L	L	L	H	H	L	H	H	H	H	H	H	$\bar{Y}1$
H	L	L	L	H	L	H	H	L	H	H	H	H	H	$\bar{Y}2$
H	L	L	L	H	H	H	H	H	L	H	H	H	H	$\bar{Y}3$
H	L	L	H	L	L	H	H	H	H	L	H	H	H	$\bar{Y}4$
H	L	L	H	L	H	H	H	H	H	H	L	H	H	$\bar{Y}5$
H	L	L	H	H	L	H	H	H	H	H	H	L	H	$\bar{Y}6$
H	L	L	H	H	H	H	H	H	H	H	H	H	L	$\bar{Y}7$

X: Don't care

System Diagram



Maximum Ratings

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	V
DC input voltage	V_{IN}	-0.5 to 7.0	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 75	mA
Power dissipation	P_D	180	mW
Storage temperature	T_{stg}	-65 to 150	$^{\circ}C$

Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 3.6	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$
Input rise and fall time	dt/dv	0 to 100	ns/V

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
					V _{CC} (V)	Min	Typ.	Max	Min		Max
Input voltage	H-level	V _{IH}	—	2.0	1.5	—	—	1.5	—	V	
				3.0	2.0	—	—	2.0	—		
				3.6	2.4	—	—	2.4	—		
	L-level	V _{IL}	—	2.0	—	—	0.5	—	0.5		
				3.0	—	—	0.8	—	0.8		
				3.6	—	—	0.8	—	0.8		
Output voltage	H-level	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				I _{OH} = -50 μA	3.0	2.9	3.0	—	2.9	—	
				I _{OH} = -4 mA	3.0	2.58	—	—	2.48	—	
	L-level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0	—	0	0.1	—	0.1	
				I _{OL} = 50 μA	3.0	—	0	0.1	—	0.1	
				I _{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
Input leakage current		I _{IN}	V _{IN} = 5.5 V or GND	3.6	—	—	±0.1	—	±1.0	μA	
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND	3.6	—	—	4.0	—	40.0	μA	

AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max		Min	Max
Propagation delay time (A, B, C- \bar{Y})	t _{pLH}	—	2.7	15	—	7.1	13.8	1.0	16.5	ns
				50	—	9.6	17.3	1.0	20.0	
	3.3 ± 0.3		15	—	5.5	8.8	1.0	10.5		
			50	—	8.0	12.3	1.0	14.0		
Propagation delay time (G1- \bar{Y})	t _{pLH}	—	2.7	15	—	8.7	16.3	1.0	19.5	ns
				50	—	11.2	19.8	1.0	23.0	
	3.3 ± 0.3		15	—	6.8	10.6	1.0	12.5		
			50	—	9.3	14.1	1.0	16.0		
Propagation delay time ($\bar{G}2 - \bar{Y}$)	t _{pLH}	—	2.7	15	—	8.8	16.0	1.0	18.5	ns
				50	—	11.3	19.5	1.0	22.0	
	3.3 ± 0.3		15	—	6.9	10.4	1.0	11.5		
			50	—	9.4	13.9	1.0	15.0		
Output to output skew	t _{osLH}	(Note 1)	2.7	50	—	—	2.5	—	2.5	ns
	t _{osHL}		3.3 ± 0.3	50	—	—	2.5	—	2.5	
Input capacitance	C _{IN}	(Note 2)		—	4	10	—	10	pF	
Power dissipation capacitance	C _{PD}	(Note 3)		—	34	—	—	—	pF	

Note 1: Parameter guaranteed by design.
 ($t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$)

Note 2: Parameter guaranteed by design.

Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

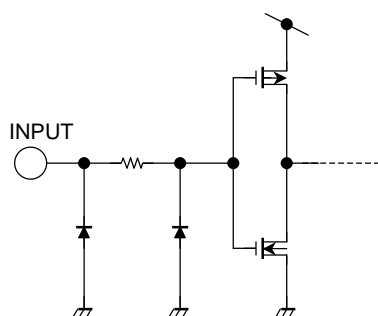
Average operating current can be obtained by the equation:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

Noise Characteristics (Ta = 25°C, input: tr = tf = 3 ns, CL = 50 pF)

Characteristics	Symbol	Test Condition	VCC (V)	Typ.	Limit	Unit	
Quiet output maximum dynamic	VOL	VOLP	—	3.3	—	0.5	V
Quiet output minimum dynamic	VOL	VOLV	—	3.3	—	-0.5	V
Minimum high level dynamic input voltage	VIH	VIHD	—	3.3	—	2.0	V
Maximum low level dynamic input voltage	VIL	VILD	—	3.3	—	0.8	V

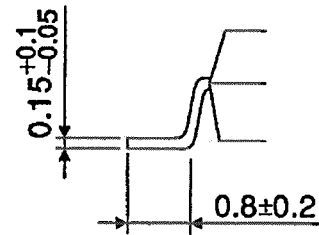
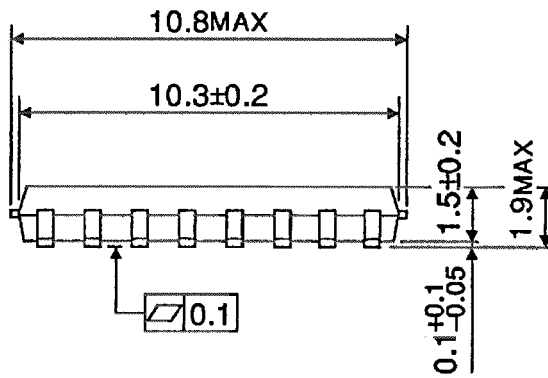
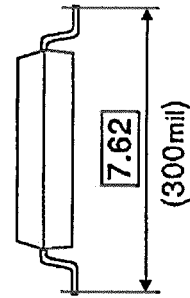
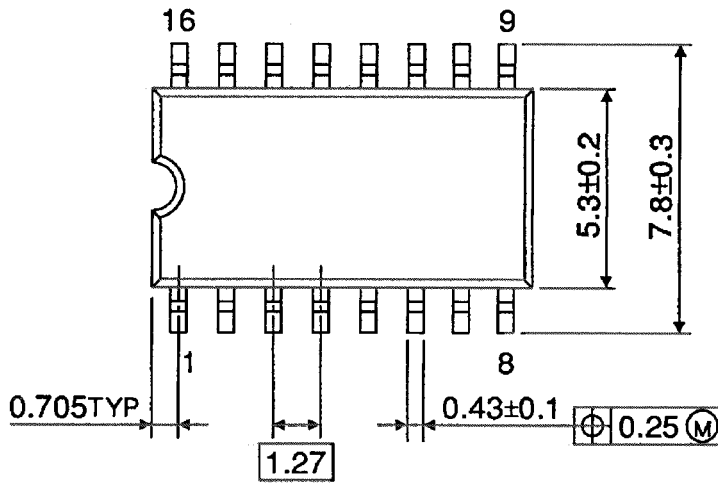
Input Equivalent Circuit



Package Dimensions

SOP16-P-300-1.27

Unit : mm

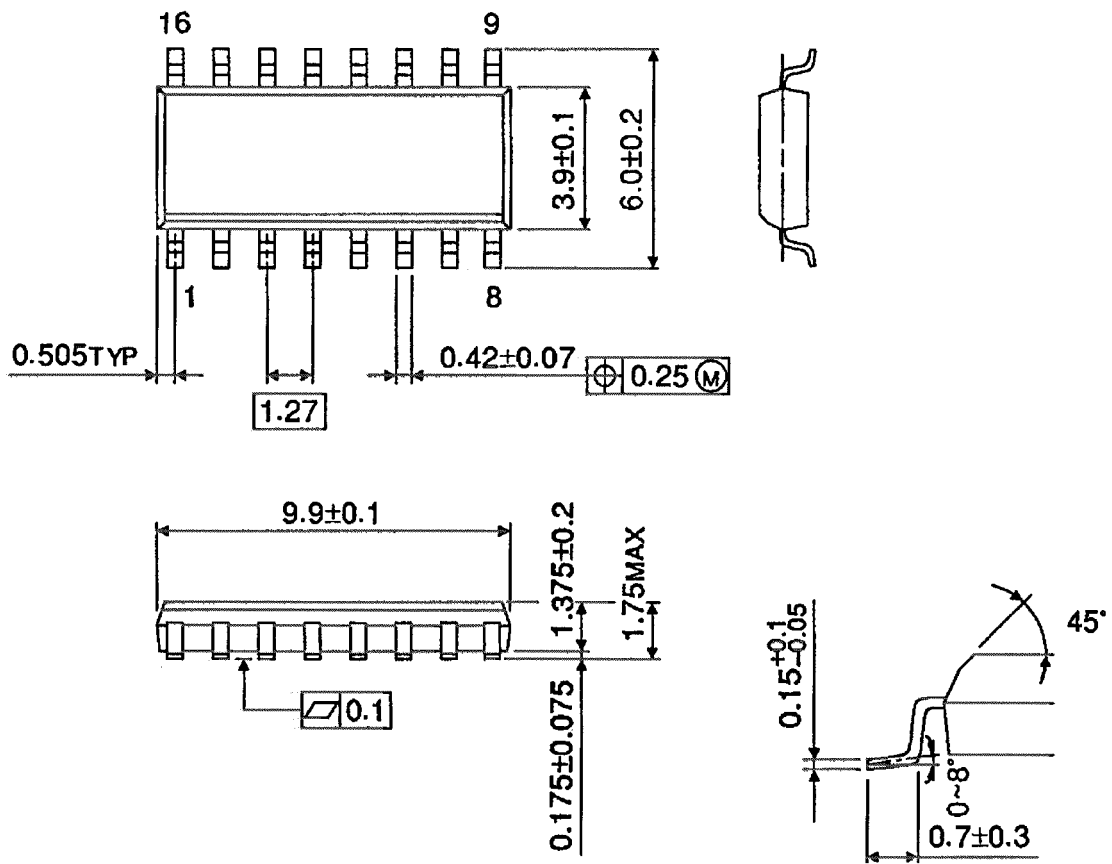


Weight: 0.18 g (typ.)

Package Dimensions

SOL16-P-150-1.27

Unit : mm

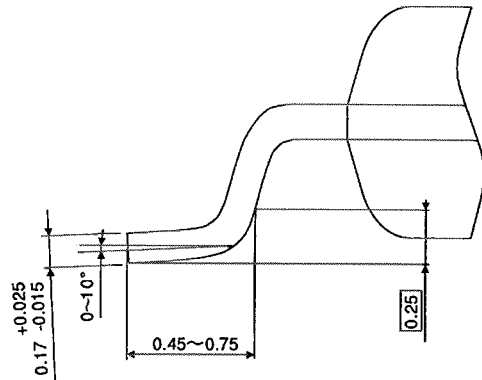
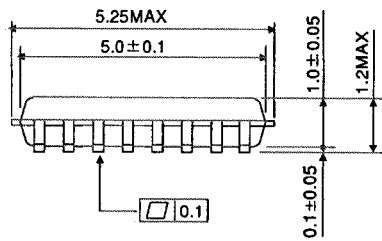
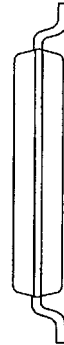
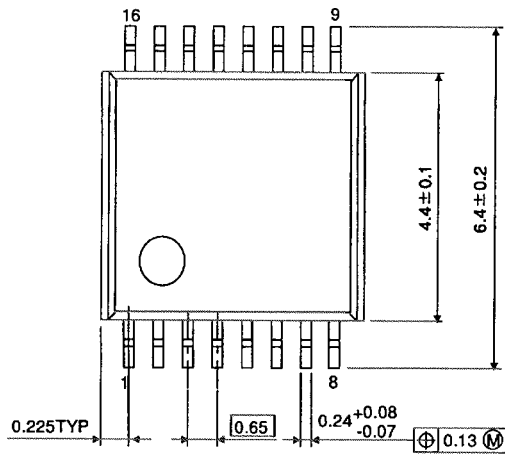


Weight: 0.12 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65

Unit : mm



Weight: 0.06 g (typ.)

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