TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74LVX138F,TC74LVX138FN,TC74LVX138FT

3-to-8 Line Decoder

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

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.

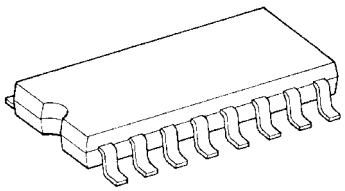
This device is suitable for low-voltage and battery operated systems.

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.

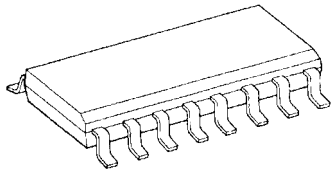
An input protection circuit ensures that 0 to 5.5V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

TC74LVX138F



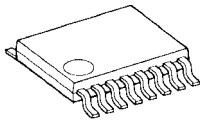
SOP16-P-300-1.27

TC74LVX138FN



SOL16-P-150-1.27

TC74LVX138FT



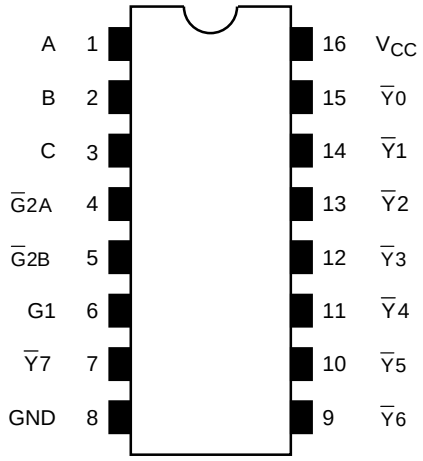
TSSOP16-P-0044-0.65

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.)

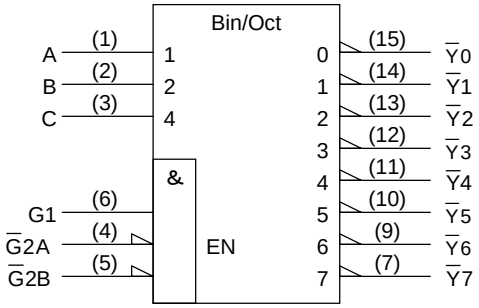
Features

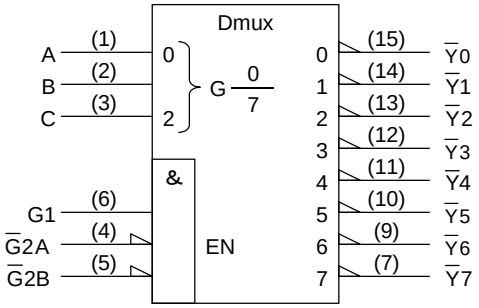
- High-speed: t_{pd} = 5.5 ns (typ.) (V_{CC} = 3.3 V)
- Low power dissipation: I_{CC} = 4 μA (max) (Ta = 25°C)
- Input voltage level: V_{IL} = 0.8 V (max) (V_{CC} = 3 V)
  V_{IH} = 2.0 V (min) (V_{CC} = 3 V)
- Power-down protection provided on all inputs
- Balanced propagation delays: $t_{pLH} \approx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

Pin Assignment (top view)



IEC Logic Symbol



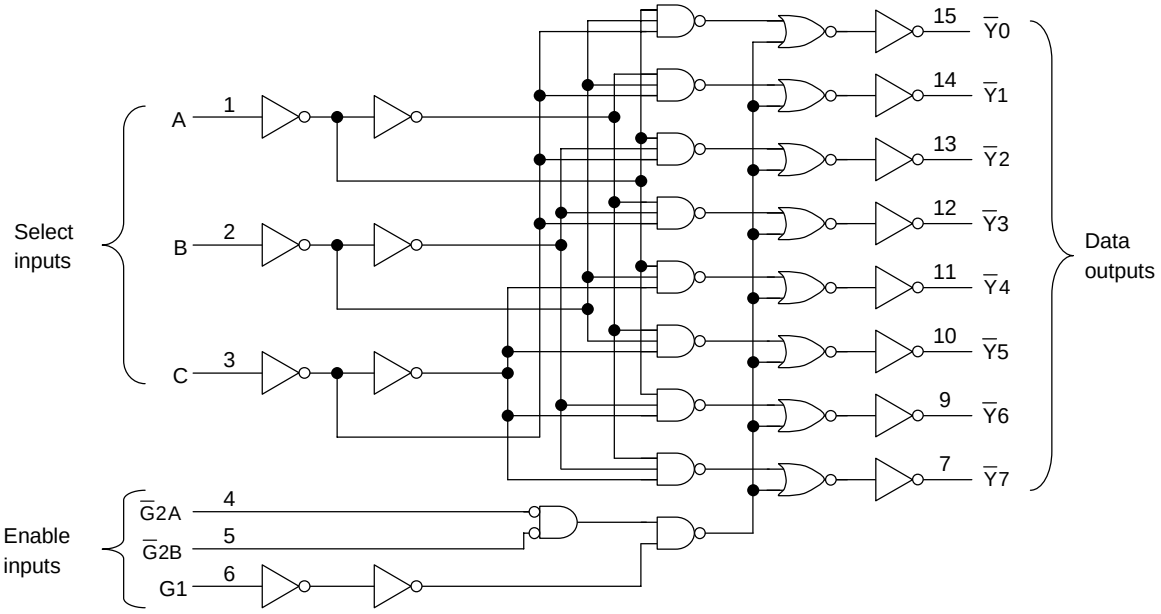


Truth Table

Inputs						Outputs								Selected Output
Enable			Select			$\overline{Y}$0	$\overline{Y}$1	$\overline{Y}$2	$\overline{Y}$3	$\overline{Y}$4	$\overline{Y}$5	$\overline{Y}$6	$\overline{Y}$7	
G1	$\overline{G}$2A	$\overline{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	$\overline{Y}$0
H	L	L	L	L	H	H	L	H	H	H	H	H	H	$\overline{Y}$1
H	L	L	L	H	L	H	H	L	H	H	H	H	H	$\overline{Y}$2
H	L	L	L	H	H	H	H	H	L	H	H	H	H	$\overline{Y}$3
H	L	L	H	L	L	H	H	H	H	L	H	H	H	$\overline{Y}$4
H	L	L	H	L	H	H	H	H	H	H	L	H	H	$\overline{Y}$5
H	L	L	H	H	L	H	H	H	H	H	H	L	H	$\overline{Y}$6
H	L	L	H	H	H	H	H	H	H	H	H	H	L	$\overline{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	°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	°C
Input rise and fall time	dt/dv	0 to 100	ns/V

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Typ.	Max	Ta = −40 to 85°C Min	Max	Unit
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: $t_r = t_f = 3$ 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- $\overline{Y}$)	t_{pLH}	—	2.7	15	—	7.1	13.8	1.0	16.5	ns
				50	—	9.6	17.3	1.0	20.0	
	t_{pHL}		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- $\overline{Y}$)	t_{pLH}	—	2.7	15	—	8.7	16.3	1.0	19.5	ns
				50	—	11.2	19.8	1.0	23.0	
	t_{pHL}		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 ($\overline{G}$2 - $\overline{Y}$)	t_{pLH}	—	2.7	15	—	8.8	16.0	1.0	18.5	ns
				50	—	11.3	19.5	1.0	22.0	
	t_{pHL}		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.
($t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$)

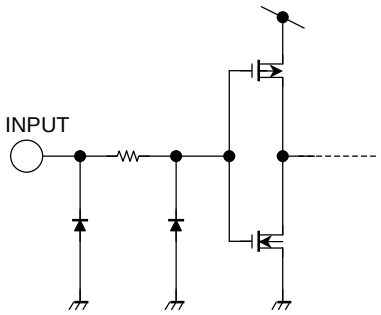
Note 2: Parameter guaranteed by design.

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: $t_r = t_f = 3$ ns, $C_L = 50$ pF)

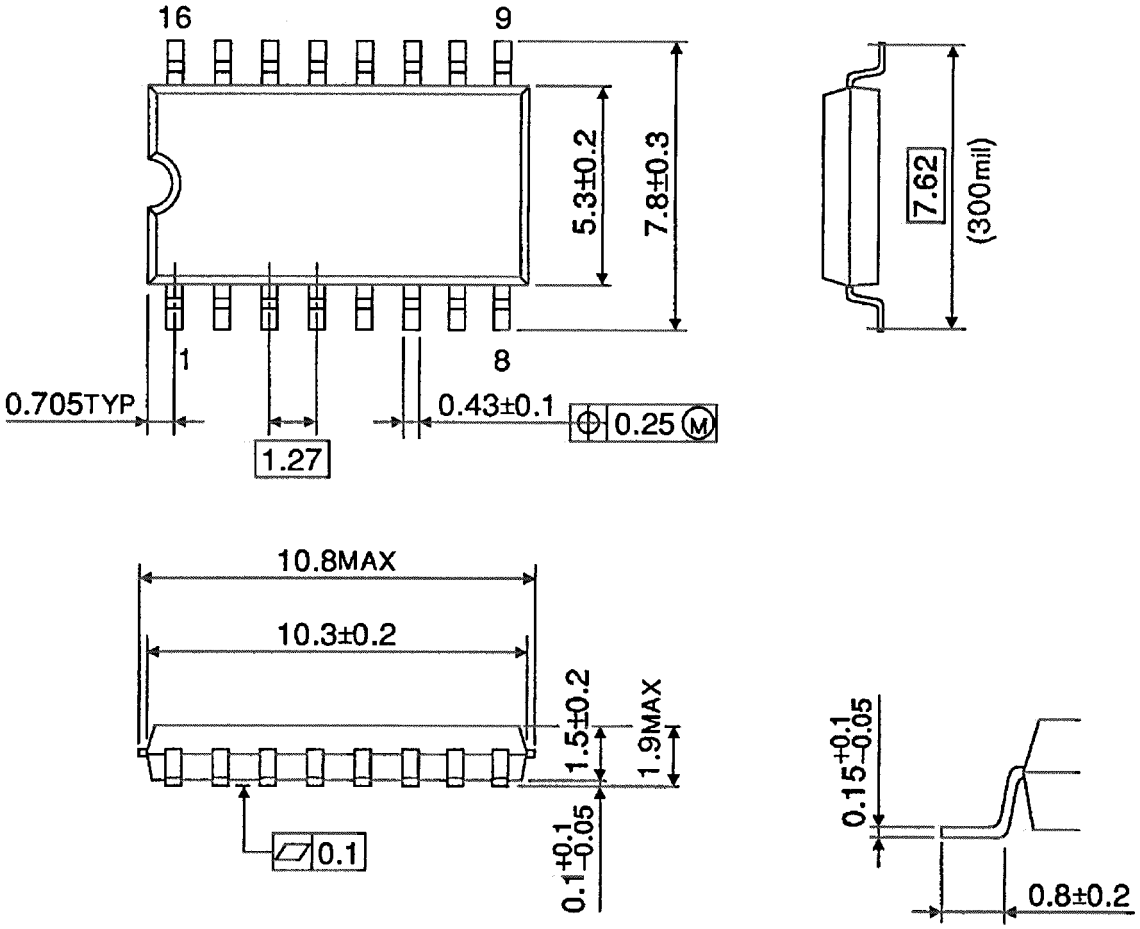
Characteristics		Symbol	Test Condition		Typ.	Limit	Unit
				V_{CC} (V)			
Quiet output maximum dynamic	V_{OL}	V_{OLP}	—	3.3	—	0.5	V
Quiet output minimum dynamic	V_{OL}	V_{OLV}	—	3.3	—	−0.5	V
Minimum high level dynamic input voltage	V_{IH}	V_{IHD}	—	3.3	—	2.0	V
Maximum low level dynamic input voltage	V_{IL}	V_{ILD}	—	3.3	—	0.8	V

Input Equivalent Circuit



Package Dimensions

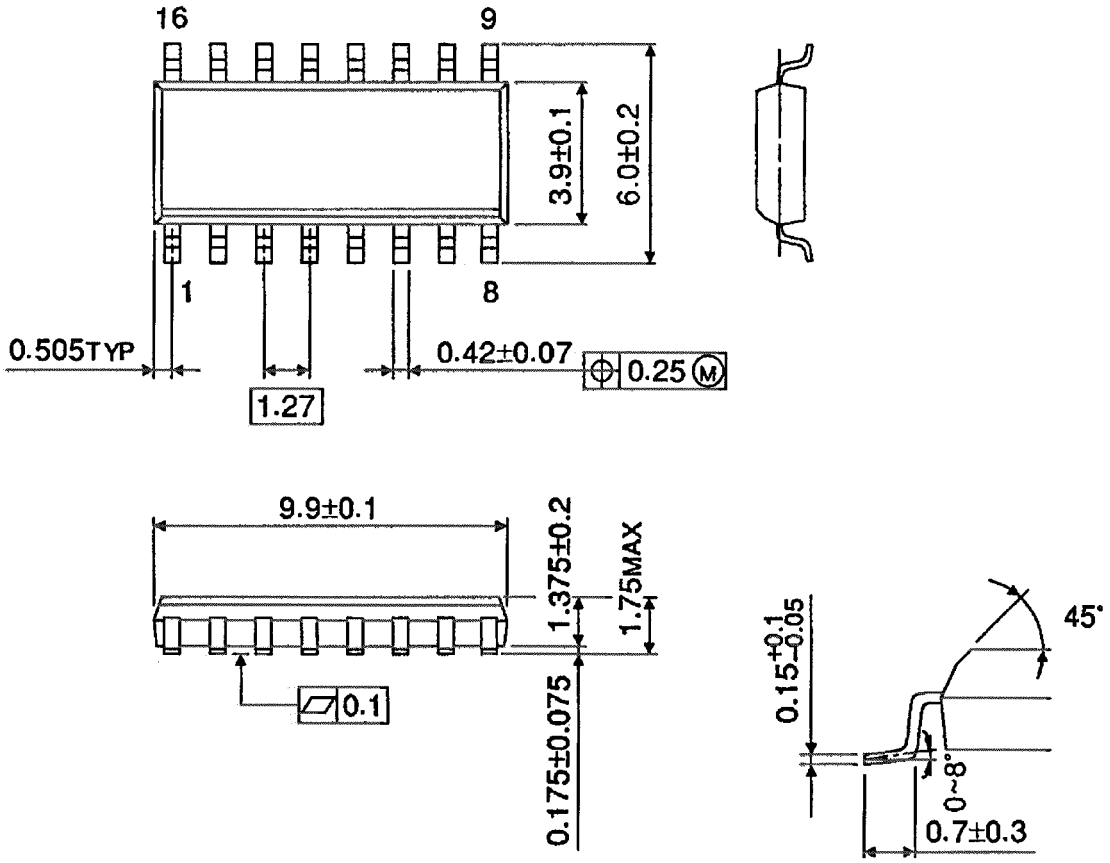
SOP16-P-300-1.27 Unit : mm



Weight: 0.18 g (typ.)

Package Dimensions

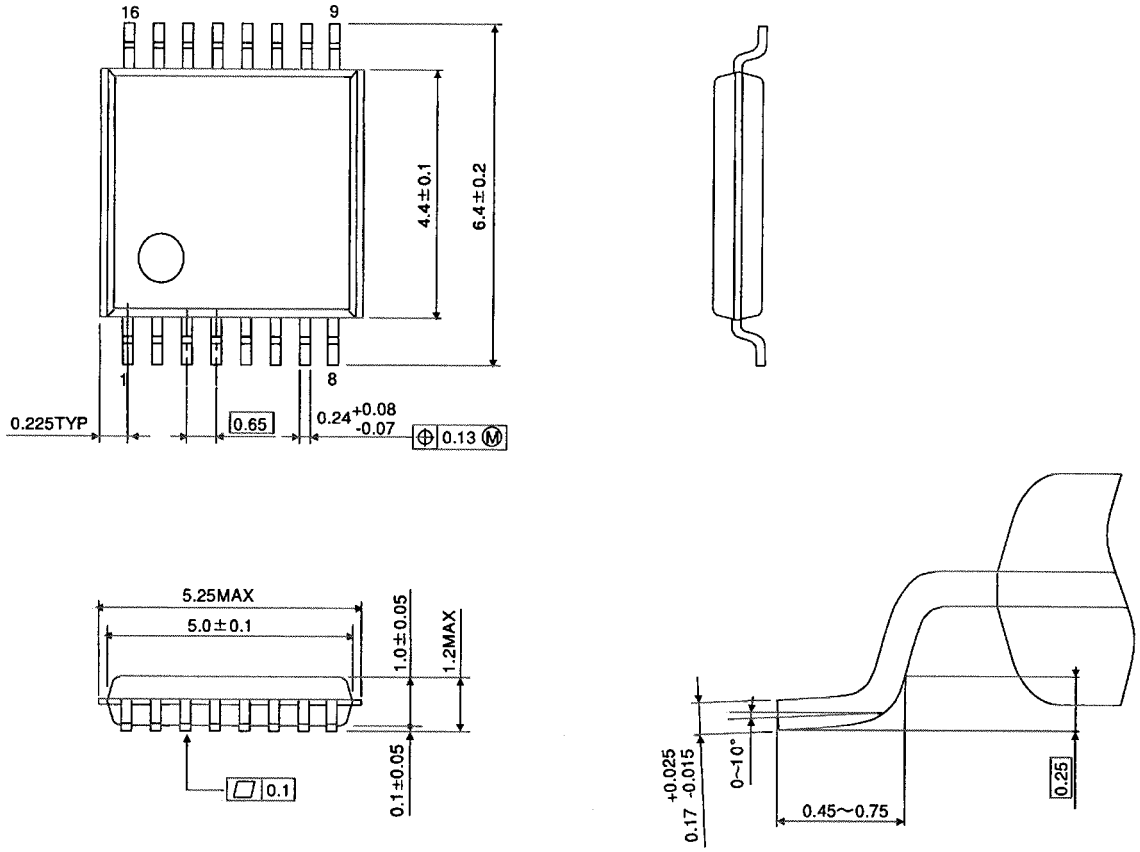
SOL16-P-150-1.27 Unit : mm



Weight: 0.12 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65 Unit : mm



Weight: 0.06 g (typ.)

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