
HD74LV138A

3-to-8 line Decoder / Demultiplexers

HITACHI

ADE-205-261 (Z)
1st Edition
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Description

The HD74LV138A is designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. The conditions at the binary-select inputs and the three enable inputs select one of eight input lines.

Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter.

An enable input can be used as a data input for demultiplexing applications.

Low-voltage and high-speed operation is suitable for the battery-powered products (e.g., notebook computers), and the low-power consumption extends the battery life.

Features

- $V_{CC} = 2.0\text{ V}$ to 5.5 V operation
- All inputs V_{IH} (Max.) = 5.5 V (@ $V_{CC} = 0\text{ V}$ to 5.5 V)
- All outputs V_O (Max.) = 5.5 V (@ $V_{CC} = 0\text{ V}$)
- Typical V_{OL} ground bounce < 0.8 V (@ $V_{CC} = 3.3\text{ V}$, $T_a = 25^\circ\text{C}$)
- Typical V_{OH} undershoot > 2.3 V (@ $V_{CC} = 3.3\text{ V}$, $T_a = 25^\circ\text{C}$)
- Output current $\pm 6\text{ mA}$ (@ $V_{CC} = 3.0\text{ V}$ to 3.6 V), $\pm 12\text{ mA}$ (@ $V_{CC} = 4.5\text{ V}$ to 5.5 V)

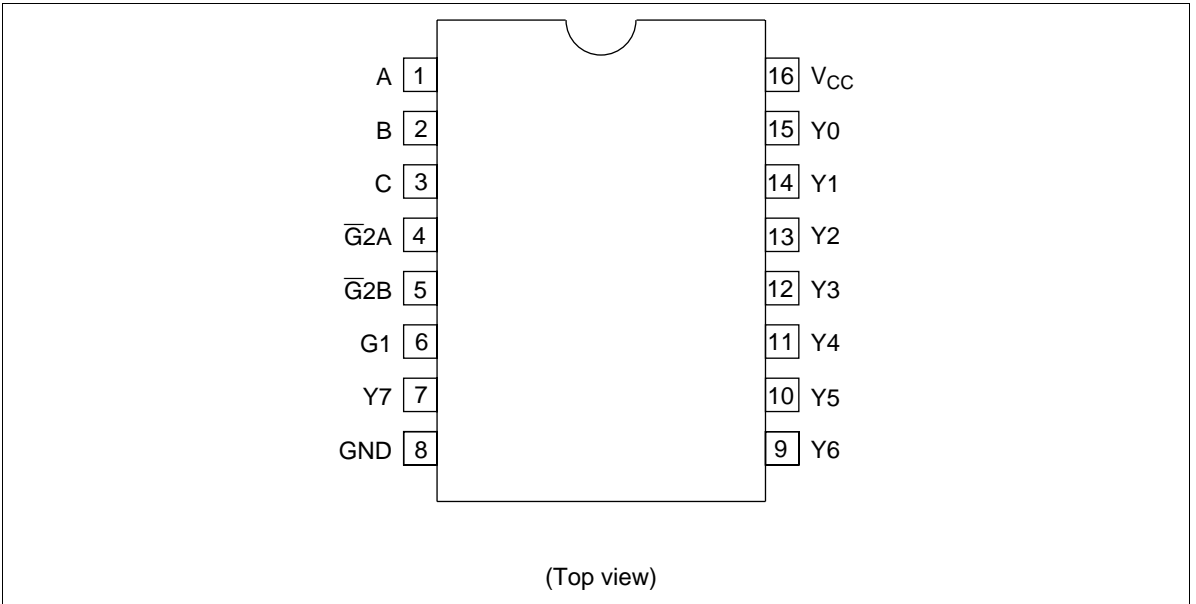
HD74LV138A

Function Table

Enable Inputs			Select Inputs			Outputs							
G1	$\overline{G2A}$	$\overline{G2B}$	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	H	L	H	H	H	H
H	L	L	H	L	L	H	H	H	H	L	H	H	H
H	L	L	H	L	H	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	H	H	H	H	H	H	H	H	H	L

Note: H: High level
L: Low level
X: Immaterial

Pin Arrangement



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CC}	-0.5 to 7.0	V	
Input voltage range* ¹	V_I	-0.5 to 7.0	V	
Output voltage range* ^{1,2}	V_O	-0.5 to $V_{CC} + 0.5$ -0.5 to 7.0	V	Output: H or L V_{CC} : OFF
Input clamp current	I_{IK}	-20	mA	$V_I < 0$
Output clamp current	I_{OK}	± 50	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	I_O	± 25	mA	$V_O = 0$ to V_{CC}
Continuous current through V_{CC} or GND	I_{CC} or I_{GND}	± 50	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* ³	P_T	785	mW	SOP
		500		TSSOP
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$	

Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

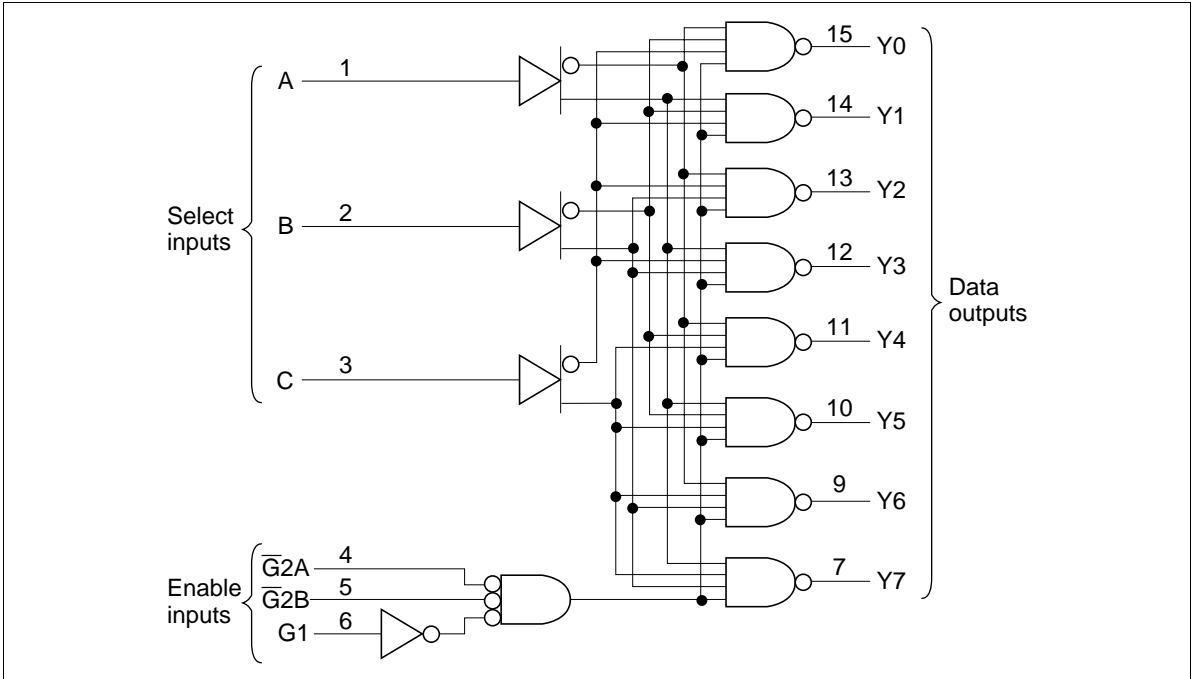
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C .

Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	V_{CC}	2.0	5.5	V	
Input voltage range	V_I	0	5.5	V	
Output voltage range	V_O	0	V_{CC}	V	H or L
Output current	I_{OH}	—	–50	μ A	$V_{CC} = 2.0$ V
		—	–2	mA	$V_{CC} = 2.3$ to 2.7 V
		—	–6		$V_{CC} = 3.0$ to 3.6 V
		—	–12		$V_{CC} = 4.5$ to 5.5 V
	I_{OL}	—	50	μ A	$V_{CC} = 2.0$ V
		—	2	mA	$V_{CC} = 2.3$ to 2.7 V
		—	6		$V_{CC} = 3.0$ to 3.6 V
		—	12		$V_{CC} = 4.5$ to 5.5 V
Input transition rise or fall rate	$\Delta t/\Delta v$	0	200	ns/V	$V_{CC} = 2.3$ to 2.7 V
		0	100		$V_{CC} = 3.0$ to 3.6 V
		0	20		$V_{CC} = 4.5$ to 5.5 V
Operating free-air temperature	T_a	–40	85	°C	

Note: Unused or floating inputs must be held high or low.

Logic Diagram



DC Electrical Characteristics

- $T_a = -40$ to 85°C

Item	Symbol	V_{CC} (V)*	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	2.0	1.5	—	—	V	
		2.3 to 2.7	$V_{CC} \times 0.7$	—	—		
		3.0 to 3.6	$V_{CC} \times 0.7$	—	—		
		4.5 to 5.5	$V_{CC} \times 0.7$	—	—		
	V_{IL}	2.0	—	—	0.5		
		2.3 to 2.7	—	—	$V_{CC} \times 0.3$		
		3.0 to 3.6	—	—	$V_{CC} \times 0.3$		
		4.5 to 5.5	—	—	$V_{CC} \times 0.3$		
Output voltage	V_{OH}	Min to Max	$V_{CC} - 0.1$	—	—	V	$I_{OH} = -50 \mu\text{A}$
		2.3	2.0	—	—		$I_{OH} = -2 \text{ mA}$
		3.0	2.48	—	—		$I_{OH} = -6 \text{ mA}$
		4.5	3.8	—	—		$I_{OH} = -12 \text{ mA}$
	V_{OL}	Min to Max	—	—	0.1		$I_{OL} = 50 \mu\text{A}$
		2.3	—	—	0.4		$I_{OL} = 2 \text{ mA}$
		3.0	—	—	0.44		$I_{OL} = 6 \text{ mA}$
		4.5	—	—	0.55		$I_{OL} = 12 \text{ mA}$
Input current	I_{IN}	0 to 5.5	—	—	± 1	μA	$V_I = 5.5 \text{ V}$ or GND
Quiescent supply current	I_{CC}	5.5	—	—	20	μA	$V_I = V_{CC}$ or GND, $I_O = 0$
Output leakage current	I_{OFF}	0	—	—	5	μA	V_I or $V_O = 0 \text{ V}$ to 5.5 V
Input capacitance	C_{IN}	3.3	—	1.7	—	pF	$V_I = V_{CC}$ or GND

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

Switching Characteristics

- $V_{CC} = 2.5 \pm 0.2 \text{ V}$

$T_a = 25^\circ\text{C}$ $T_a = -40 \text{ to } 85^\circ\text{C}$

Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay time	t_{PLH}	—	11.7	17.6	1.0	21.0	ns	$C_L = 15 \text{ pF}$	A, B, C	Y
	t_{PHL}	—	14.9	21.4	1.0	25.0		$C_L = 50 \text{ pF}$		
		—	12.3	19.2	1.0	22.0		$C_L = 15 \text{ pF}$	G1	
		—	15.7	22.6	1.0	26.0		$C_L = 50 \text{ pF}$		
		—	11.4	18.2	1.0	21.0		$C_L = 15 \text{ pF}$	$\overline{G2A}$, $\overline{G2B}$	
		—	14.8	22.0	1.0	25.0		$C_L = 50 \text{ pF}$		

- $V_{CC} = 3.3 \pm 0.3 \text{ V}$

$T_a = 25^\circ\text{C}$ $T_a = -40 \text{ to } 85^\circ\text{C}$

Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay time	t_{PLH}	—	8.1	11.4	1.0	13.5	ns	$C_L = 15 \text{ pF}$	A, B, C	Y
	t_{PHL}	—	10.3	15.8	1.0	18.0		$C_L = 50 \text{ pF}$		
		—	8.4	12.8	1.0	15.0		$C_L = 15 \text{ pF}$	G1	
		—	10.6	16.3	1.0	18.5		$C_L = 50 \text{ pF}$		
		—	7.8	11.4	1.0	13.5		$C_L = 15 \text{ pF}$	$\overline{G2A}$, $\overline{G2B}$	
		—	10.0	14.9	1.0	17.0		$C_L = 50 \text{ pF}$		

Switching Characteristics (cont)

- $V_{CC} = 5.0 \pm 0.5 \text{ V}$

$T_a = 25^\circ\text{C}$ $T_a = -40 \text{ to } 85^\circ\text{C}$

Item	Symbol	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propa- gation delay time	t_{PLH}	—	5.6	8.1	1.0	9.5	ns	$C_L = 15 \text{ pF}$	A, B, C	Y
	t_{PHL}	—	7.0	10.1	1.0	11.5		$C_L = 50 \text{ pF}$		
		—	5.7	8.1	1.0	9.5		$C_L = 15 \text{ pF}$	G1	
		—	7.1	10.1	1.0	11.5		$C_L = 50 \text{ pF}$		
		—	5.4	8.1	1.0	9.5		$C_L = 15 \text{ pF}$	$\overline{G2A}$, $\overline{G2B}$	
		—	6.8	10.1	1.0	11.5		$C_L = 50 \text{ pF}$		

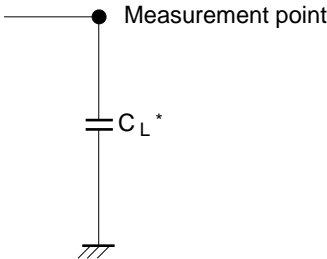
Operating Characteristics

- $C_L = 50 \text{ pF}$

$T_a = 25^\circ\text{C}$

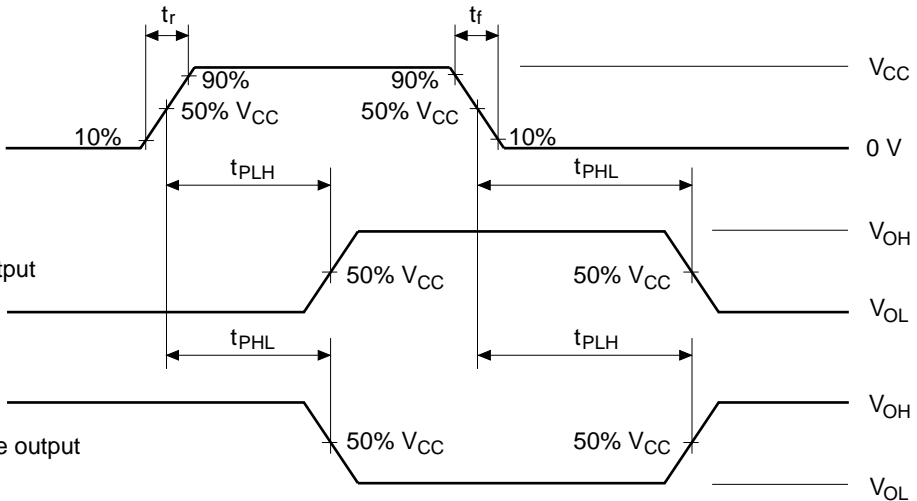
Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C_{PD}	3.3	—	16.8	—	pF	$f = 10 \text{ MHz}$
		5.0	—	19.1	—		

Test Circuit



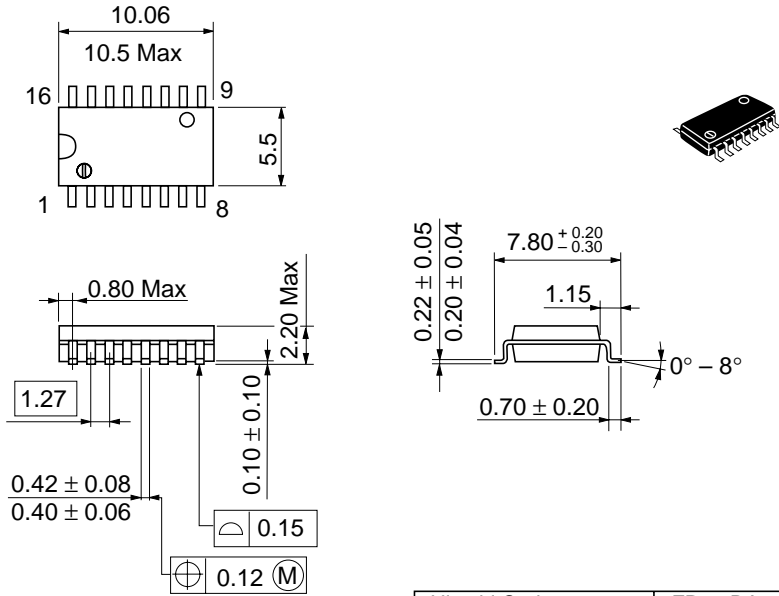
Note: C_L includes the probe and jig capacitance.

• Waveform



- Notes: 1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$
- 2. The output is measured one at a time with one transition per measurement.

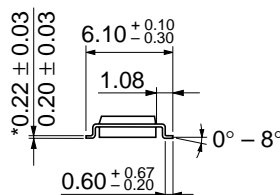
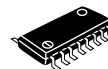
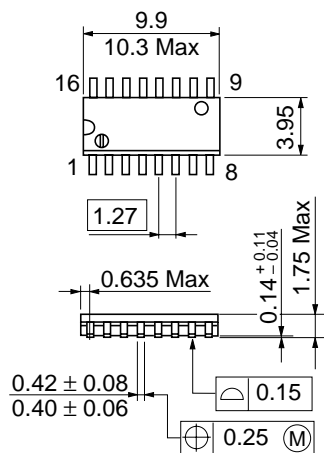
Package Dimensions



Dimension including the plating thickness
Base material dimension

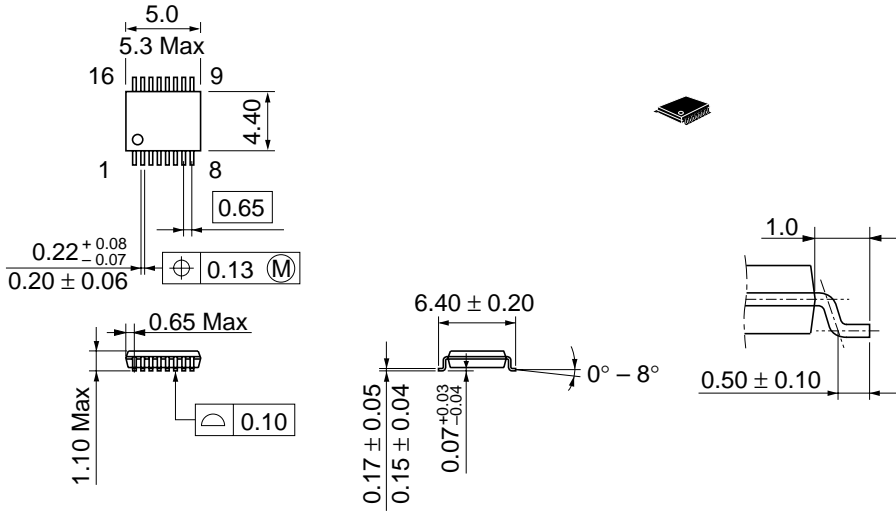
Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g

Unit: mm



Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g



Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-16DA
JEDEC	—
EIAJ	—
Weight (reference value)	0.05 g

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