

HD74LV138A

3-to-8-line Decoder / Demultiplexer

REJ03D0384-0100

Rev.1.00

Aug. 23, 2004

Description

The HD74LV138A has three binary select inputs in a 16 pin package. If the device is enabled these inputs determine which one of the eight normally high outputs will go low. Two active low and one active high enables are provided to ease the cascading of decoders. Low voltage and high-speed operation is suitable at the battery drive product (note type personal computer) and low power consumption extends the life of a battery for long time operation.

Features

- $V_{CC} = 2.0\text{ V}$ to 5.5 V
- 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 $< 0.8\text{ V}$ (@ $V_{CC} = 3.3\text{ V}$, $T_a = 25^\circ\text{C}$)
- Typical V_{OH} undershoot $> 2.3\text{ V}$ (@ $V_{CC} = 3.3\text{ V}$, $T_a = 25^\circ\text{C}$)
- High 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)
- Ordering Information

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LV138AFPEL	SOP-16 pin (JEITA)	FP-16DAV	FP	EL (2,000 pcs/reel)
HD74LV138ATELL	TSSOP-16 pin	TTP-16DAV	T	ELL (2,000 pcs/reel)

Note: Please consult the sales office for the above package availability.

Function Table

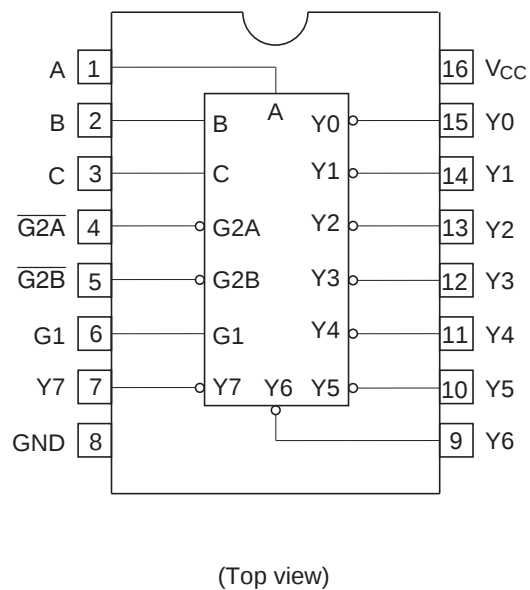
Inputs						Outputs							
Enable			Select										
G1	G2A	G2B	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	X	H	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	H	L	H	H	H	H
H	L	L	H	L	L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

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 $V_{CC} + 0.5$	V	Output: H or L
		-0.5 to 7.0		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	°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	
Output current	I_{OH}	—	−50	μA	$V_{CC} = 2.0\text{ V}$
		—	−2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	−6		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	−12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
	I_{OL}	—	50	μA	$V_{CC} = 2.0\text{ V}$
		—	2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	6		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		0	100		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		0	20		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
Operating free-air temperature	T_a	−40	85	$^{\circ}C$	

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

DC Electrical Characteristics

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

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	$I_{OH} = -50\text{ }\mu A$
		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		$I_{OL} = 50\text{ }\mu A$
		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	$V_{IN} = 5.5\text{ V or GND}$
Quiescent supply current	I_{CC}	5.5	—	—	20	μA	$V_{IN} = V_{CC}\text{ or GND, } I_O = 0$
Output leakage current	I_{OFF}	0	—	—	5	μA	$V_I\text{ or }V_O = 0\text{ V to }5.5\text{ V}$
Input capacitance	C_{IN}	3.3	—	3.3	—	pF	$V_I = V_{CC}\text{ or GND}$

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

Switching Characteristics

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

Item	Symbol	Ta = 25°C			Ta = −40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	t _{PLH} /t _{PHL}	—	7.5	17.6	1.0	21.0	ns	C _L = 15 pF	A, B or C	Y
		—	10.0	21.4	1.0	25.0		C _L = 50 pF		
		—	7.5	19.2	1.0	22.0		C _L = 15 pF	G1	
		—	10.0	22.6	1.0	26.0		C _L = 50 pF		
		—	8.0	18.2	1.0	21.0		C _L = 15 pF	G2A or G2B	
		—	10.5	22.0	1.0	25.0		C _L = 50 pF		

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

Item	Symbol	Ta = 25°C			Ta = −40 to 85°C		Unit	Test	FROM	TO
		Min	Typ	Max	Min	Max		Conditions	(Input)	(Output)
Propagation delay time	t _{PLH} /t _{PHL}	—	5.5	11.4	1.0	13.5	ns	C _L = 15 pF	A, B or C	Y
		—	7.5	15.8	1.0	18.0		C _L = 50 pF		
		—	5.5	12.8	1.0	15.0		C _L = 15 pF	G1	
		—	7.5	16.3	1.0	18.5		C _L = 50 pF		
		—	6.0	11.4	1.0	13.5		C _L = 15 pF	G2A or G2B	
		—	7.5	14.9	1.0	17.0		C _L = 50 pF		

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

Item	Symbol	Ta = 25°C			Ta = −40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	t _{PLH} /t _{PHL}	—	4.0	8.1	1.0	9.5	ns	C _L = 15 pF	A, B or C	Y
		—	5.5	10.1	1.0	11.5		C _L = 50 pF		
		—	4.0	8.1	1.0	9.5		C _L = 15 pF	G1	
		—	5.5	10.1	1.0	11.5		C _L = 50 pF		
		—	4.5	8.1	1.0	9.5		C _L = 15 pF	G2A or G2B	
		—	5.5	10.1	1.0	11.5		C _L = 50 pF		

Operating Characteristics

$$C_L = 50 \text{ pF}$$

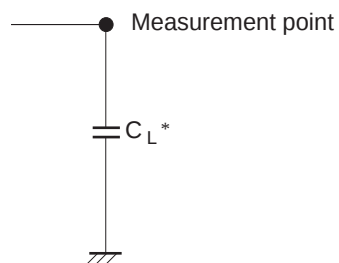
Item	Symbol	V _{CC} (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C _{PD}	3.3	—	16.8	—	pF	f = 10 MHz
		5.0	—	19.1	—		

Noise Characteristics

 $C_L = 50 \text{ pF}$

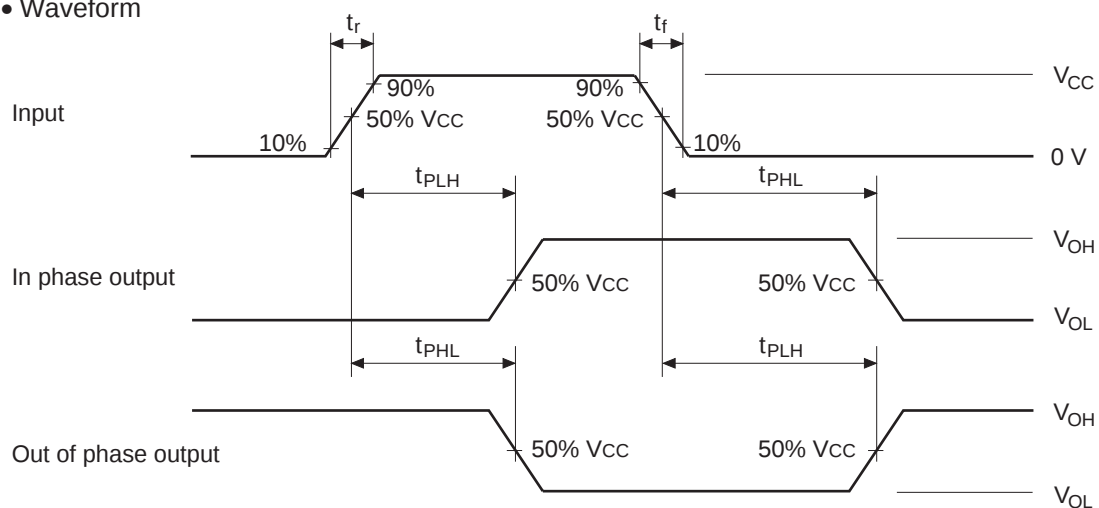
Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic V_{OL}	$V_{OL(P)}$	3.3	—	0.3	0.8	V	
Quiet output, minimum dynamic V_{OL}	$V_{OL(V)}$	3.3	—	-0.2	-0.8	V	
Quiet output, minimum dynamic V_{OH}	$V_{OH(V)}$	3.3	—	3.0	—	V	
High-level dynamic input voltage	$V_{IH(D)}$	3.3	2.31	—	—	V	
Low-level dynamic input voltage	$V_{IL(D)}$	3.3	—	—	0.99	V	

Test Circuit



Note: C_L includes the probe and jig capacitance.

• Waveform

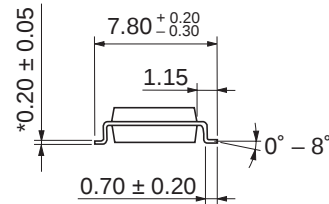
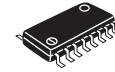
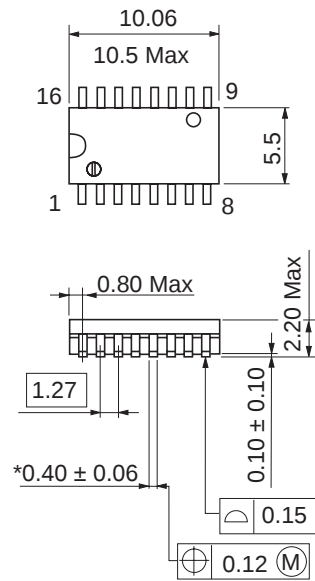


Notes: 1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$
 2. The output are measured one at a time with one transition per measurement.

Package Dimensions

As of January, 2003

Unit: mm

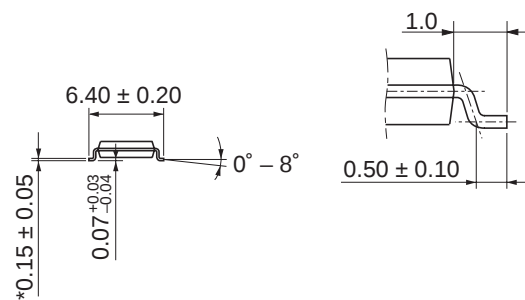
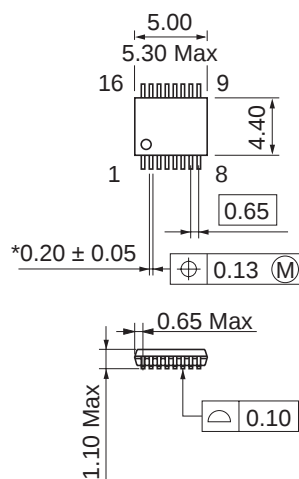


Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm



Package Code	TTP-16DAV
JEDEC	—
JEITA	—
Mass (reference value)	0.05 g

*Ni/Pd/Au plating

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