Integrated Device Technology, Inc.

HIGH-SPEED CMOS DUAL 1-OF-4 DECODER

IDT54/74AHCT139

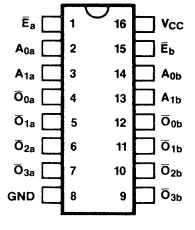
FEATURES:

- Equivalent to ALS speeds and output drive over full temperature and voltage supply extremes
- 9ns typical address to output delay
- I_{OL} = 14mA over full military temperature range
- CMOS power levels (5μW typ. static)
- Both CMOS and TTL output compatible
- Substantially lower input current levels than ALS (5μA max.)
- Dual 1-of-4 decoder with enable
- 100% product assurance screening to MIL-STD-883, Class B is available
- JEDEC standard pinout for DIP and LCC

DESCRIPTION:

The IDT54/74AHCT139 are dual 1-of-4 decoders built using advanced CEMOS™, a dual metal CMOS technology. The device has two independent decoders, each of which accept two binary weighed inputs (A_0-A_1) and provides four mutually exclusive active LOW outputs ($\overline{O}_0$-$\overline{O}_3$). Each decoder has an active LOW enable ($\overline{E}$). When $\overline{E}$ is HIGH, all outputs are forced HIGH.

PIN CONFIGURATIONS



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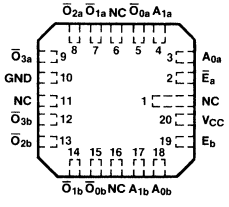
DIP
TOP VIEW



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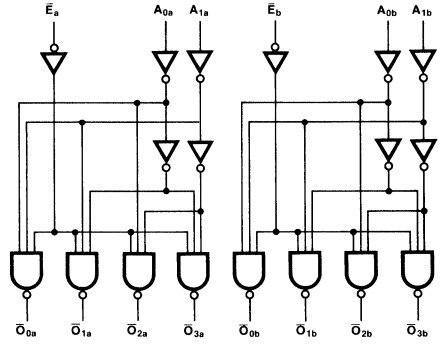
LCC
TOP VIEW

FUNCTIONAL BLOCK DIAGRAM



SSD54/74AHCT139-003

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ABSOLUTE MAXIMUM RATING(1)

SYMBOL	RATING	COMMERCIAL	MILITARY	UNIT
V_{TERM}	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
T_A	Operating Temperature	0 to +70	-55 to +125	°C
T_{BIAS}	Temperature Under Bias	-55 to +125	-65 to +135	°C
T_{STG}	Storage Temperature	-55 to +125	-65 to +155	°C
I_{OUT}	DC Output Current	120	120	mA

NOTE:
1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

T_A = 0°C to +70°C V_{CC} = 5.0V ± 5% Min. = 4.75V Max. = 5.25V (Commercial)
T_A = -55°C to +125°C V_{CC} = 5.0V ± 10% Min. = 4.50V Max. = 5.50V (Military)
V_{LC} = 0.2V
V_{HC} = V_{CC} - 0.2V

SYMBOL	PARAMETER	TEST CONDITIONS(1)		MIN.	TYP.(2)	MAX.	UNIT
V_{IH}	Input HIGH Level	Guaranteed Logic High Level		2.0	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic Low Level		—	—	0.8	V
I_{IH}	Input HIGH Current	V_{CC} = Max., V_{IN} = V_{CC}		—	—	5	µA
I_{IL}	Input LOW Current	V_{CC} = Max., V_{IN} = GND		—	—	-5	µA
I_{SC}	Input Short Circuit Current	V_{CC} = Max.(3)		-60	-100	—	mA
V_{OH}	Output HIGH Voltage	V_{CC} = 3V, V_{IN} = V_{LC} or V_{HC}, I_{OH} = -32µA		V_{HC}	V_{CC}	—	V
		V_{CC} = Min., V_{IN} = V_{IH} or V_{IL}	I_{OH} = -150µA	V_{HC}	V_{CC}	—	
			I_{OH} = -1.0mA MIL	2.4	4.3	—	
			I_{OH} = -2.6mA COM	2.4	4.3	—	
V_{OL}	Output LOW Voltage	V_{CC} = 3V, V_{IN} = V_{LC} or V_{HC}, I_{OL} = 300µA		—	GND	V_{LC}	V
		V_{CC} = Min., V_{IN} = V_{IH} or V_{IL}	I_{OL} = 300µA	—	GND	V_{LC}	
			I_{OL} = 14mA MIL	—	—	0.4	
			I_{OL} = 24mA COM	—	—	0.5	

NOTES:
1. For conditions shown as max. or min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient and maximum loading.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.

5

POWER SUPPLY CHARACTERISTICS

V_{LC} = 0.2V; V_{HC} = V_{CC} - 0.2V

SYMBOL	PARAMETER	TEST CONDITIONS[1]		MIN.	TYP.[2]	MAX.	UNIT
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = Max. $V_{IN} \geq V_{HC}$; $V_{IN} \leq V_{LC}$ f_i = 0		—	0.001	1.5	mA
I_{CCT}	Power Supply Current Per TTL Input HIGH	V_{CC} = Max. V_{IN} = 3.4V[3]		—	0.5	1.6	mA
I_{CCD}	Dynamic Power Supply Current	V_{CC} = Max. Outputs Open One Input Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$	—	0.15	0.3	mA/ MHz
I_{CC}	Total Power Supply Current[4]	V_{CC} = Max. Outputs Open f_i = 1.0MHz 50% Duty Cycle One Input Toggling	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (AHCT)	—	0.15	1.8	mA
			V_{IN} = 3.4V V_{IN} = GND	—	0.4	2.6	
		V_{CC} = Max. Outputs Open f_i = 1.0MHz 50% Duty Cycle One Input Toggling on Each Decoder	$V_{IN} \geq V_{HC}$ $V_{IN} \leq V_{LC}$ (AHCT)	—	0.3	2.1	
			V_{IN} = 3.4V V_{IN} = GND	—	0.8	3.7	

NOTES:

1. For conditions shown as max. or min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient and maximum loading.
3. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
4. $I_{CC} = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_{CC} = I_{CCQ} + I_{CCT}D_HN_T + I_{CCD}(f_{CP}/2 + f_iN_i)$
   I_{CCQ} = Quiescent Current
   I_{CCT} = Power Supply Current for a TTL High Input (V_{IN} = 3.4V)
   D_H = Duty Cycle for TTL Inputs High
   N_T = Number of TTL Inputs at D_H
   I_{CCD} = Dynamic Current caused by an Input Transition pair (HLH or LHL)
   f_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   f_i = Input Frequency
   N_i = Number of Inputs at f_i

All currents are in milliamps and all frequencies are in megahertz.

TRUTH TABLE

INPUTS			OUTPUTS			
$\overline{E}$	A_0	A_1	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
Z = High Impedance

DEFINITION OF FUNCTIONAL TERMS

PIN NAMES	DESCRIPTION
A_0, A_1	Address Inputs
$\overline{E}$	Enable Inputs (Active LOW)
$\overline{O}_0$-$\overline{O}_3$	Outputs (Active LOW)

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

SYMBOL	PARAMETER	CONDITION	TYPICAL	COMMERCIAL		MILITARY		UNITS
				MIN.	MAX.	MIN.	MAX.	
t_{PLH} t_{PHL}	Propagation Delay A_0 or A_1 to $\overline{O}_N$	C_L = 50 pf R_L = 500 Ω	9.0	5.0	20.0	5.0	25.0	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to $\overline{O}_N$		11.0	5.0	15.0	5.0	18.0	ns