Integrated Device Technology, Inc.

FAST CMOS DUAL 1-OF-4 DECODER WITH ENABLE

IDT54/74FCT139T
IDT54/74FCT139AT
IDT54/74FCT139CT

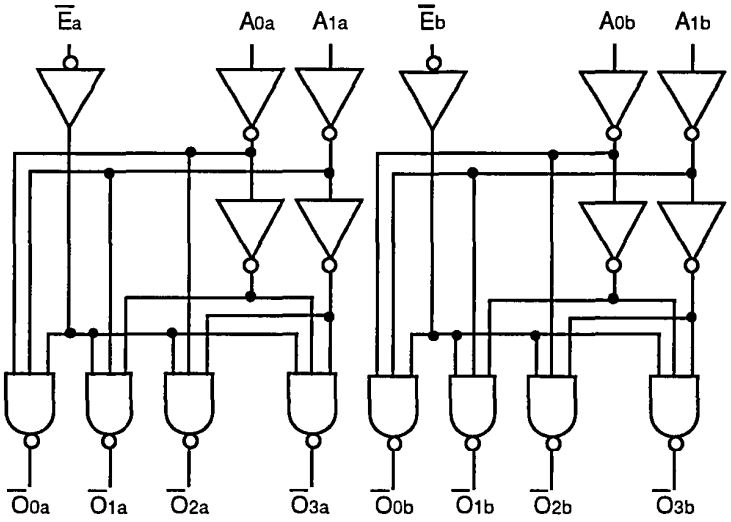
FEATURES:

- IDT54/74FCT139T equivalent to FAST™ speed
- **IDT54/74FCT139AT 35% faster than FAST**
- **IDT54/74FCT139CT 45% faster than FAST**
- Equivalent to FAST output drive over full temperature and voltage supply extremes
- I_{OL} = 48mA (commercial) and 32mA (military)
- CMOS power levels (1mW typ. static)
- TTL input and output level compatible
- Substantially lower input current levels than FAST (5µA max.)
- JEDEC standard pinout for DIP and LCC
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B

DESCRIPTION:

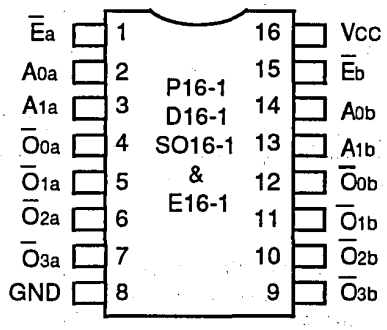
The IDT54/74FCT139T/AT/CT are dual 1-of-4 decoders built using advanced CEMOS™, a dual metal CMOS technology. These devices have two independent decoders, each of which accept two binary weighted inputs (A_0-A_1) and provide four mutually exclusive active LOW outputs ($\overline{O}_0$-$\overline{O}_3$). Each decoder has an active LOW enable ($\overline{E}$). When $\overline{E}$ is HIGH, all outputs are forced HIGH.

FUNCTIONAL BLOCK DIAGRAM



2566 cnv* 03

PIN CONFIGURATIONS



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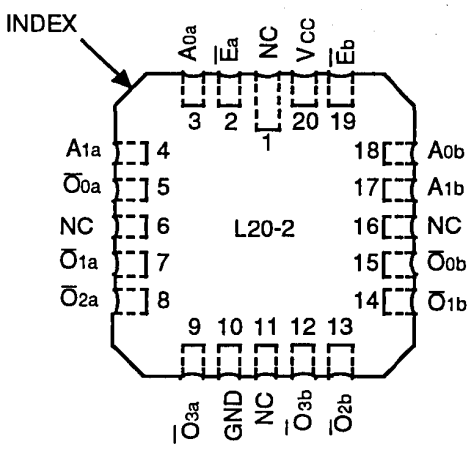
DIP/SOIC/CERPACK TOP VIEW



2566 cnv* 02

LCC TOP VIEW

CEMOS is a trademark of Integrated Device Technology, Inc.
FAST is a trademark of National Semiconductor Co.

PIN DESCRIPTION

Pin Names	Description
A_0, A_1	Address Inputs
$\overline{E}$	Enable Input (Active LOW)
$\overline{O_0}$ - $\overline{O_3}$	Outputs (Active LOW)

2566 tbl 07

FUNCTION TABLE[1]

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

NOTE:
2566 tbl 06

1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Rating	Commercial	Military	Unit
V_{TERM}[2]	Terminal Voltage with Respect to GND	–0.5 to +7.0	–0.5 to +7.0	V
V_{TERM}[3]	Terminal Voltage with Respect to GND	–0.5 to Vcc	–0.5 to Vcc	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 +150	°C
P_T	Power Dissipation	0.5	0.5	W
I_{OUT}	DC Output Current	120	120	mA

NOTES:
2566 tbl 01

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. No terminal voltage may exceed Vcc by +0.5V unless otherwise noted.
2. Input and Vcc terminals only.
3. Outputs and I/O terminals only.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter[1]	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	6	10	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	8	12	pF

NOTE:
2566 tbl 02

1. This parameter is measured at characterization but not tested.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Commercial: T_A = 0°C to +70°C, V_{CC} = 5.0V ± 5%; Military: T_A = –55°C to +125°C, V_{CC} = 5.0V ± 10%

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_I = 2.7V	—	—	5	µA
I_{IL}	Input LOW Current	V_{CC} = Max.	V_I = 0.5V	—	—	–5	µA
I_I	Input HIGH Current	V_{CC} = Max., V_I = V_{CC} (Max.)		—	—	20	µA
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_N = –18mA		—	–0.7	–1.2	V
I_{OS}	Short Circuit Current	V_{CC} = Max.[3], V_O = GND		–60	–120	–225	mA
V_{OH}	Output HIGH Voltage	V_{CC} = Min. V_{IN} = V_{IH} or V_{IL}	I_{OH} = –6mA MIL. I_{OH} = –8mA COM'L.	2.4	3.3	—	V
			I_{OH} = –12mA MIL. I_{OH} = –15mA COM'L.	2.0	3.0	—	V
V_{OL}	Output LOW Voltage	V_{CC} = Min. V_{IN} = V_{IH} or V_{IL}	I_{OL} = 32mA MIL. I_{OL} = 48mA COM'L.	—	0.3	0.5	V
V_H	Input Hysteresis	—		—	200	—	mV
I_{CC}	Quiescent Power Supply Current	V_{CC} = Max. V_{IN} = GND or V_{CC}		—	0.2	1.5	mA

2566 tbl 03

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.

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POWER SUPPLY CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC} = Max. V_{IN} = 3.4V[3]		—	0.5	2.0	mA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = Max. Outputs Open One Bit Toggling 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	0.15	0.3	mA/ MHz
I_C	Total Power Supply Current[6]	V_{CC} = Max. Outputs Open f_0 = 10MHz 50% Duty Cycle One Output Toggling	V_{IN} = V_{CC} V_{IN} = GND	—	1.7	4.5	mA
			V_{IN} = 3.4V V_{IN} = GND	—	2.0	5.5	
		V_{CC} = Max. Outputs Open f_0 = 10MHz 50% Duty Cycle One Output Toggling on Each Decoder	V_{IN} = V_{CC} V_{IN} = GND	—	3.2	7.5[5]	
			V_{IN} = 3.4V V_{IN} = GND	—	3.7	9.5[5]	

NOTES:

2566 tbl 04

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.
3. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
5. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_0 N_O)$
   I_{CC} = Quiescent Current
   ΔI_{CC} = 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 Output Transition Pair (HLH or LHL)
   f_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   f_0 = Output Frequency
   N_O = Number of Outputs at f_0
   All currents are in milliamps and all frequencies are in megahertz.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

			IDT54/74FCT139T				IDT54/74FCT139AT				IDT54/74FCT139CT				
			Com'l.		Mil.		Com'l.		Mil.		Com'l.		Mil.		
Parameter	Description	Condition[1]	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Unit
t_{PLH} t_{PHL}	Propagation Delay A_0 or A_1 to $\overline{O}_n$	C_L = 50pF R_L = 500Ω	1.5	9.0	1.5	12.0	1.5	5.9	1.5	7.8	1.5	5.0	1.5	6.2	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to $\overline{O}_n$		1.5	8.0	1.5	9.0	1.5	5.5	1.5	7.2	1.5	4.8	1.5	5.8	ns

NOTES:

2566 tbl 08

1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.