FAST CMOS 1-OF-8 DECODER WITH ENABLE

IDT54/74FCT138T/AT/CT

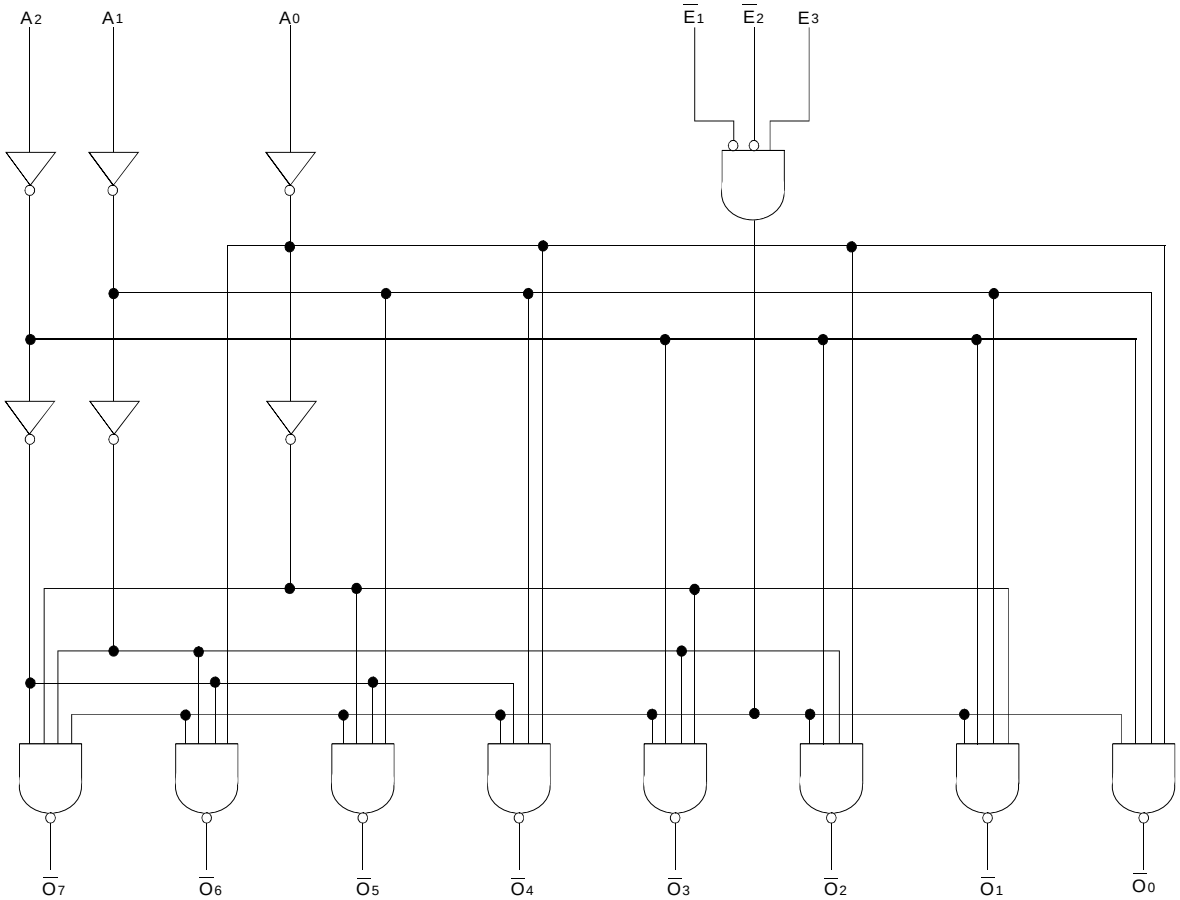
FEATURES:

- Std., A and C speed grades
- Low input and output leakage ≤ 1µA (max.)
- Extended commercial range of – 40°C to +85°C
- CMOS power levels
- True TTL input and output compatibility
  - V_{OH} = 3.3V (typ.)
  - V_{OL} = 0.3V (typ.)
- High Drive outputs (-15mA I_{OH}, 48mA I_{OL})
- Meets or exceeds JEDEC standard 18 specifications
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
- Available in DIP, SOIC, QSOP, CERPACK and LCC packages

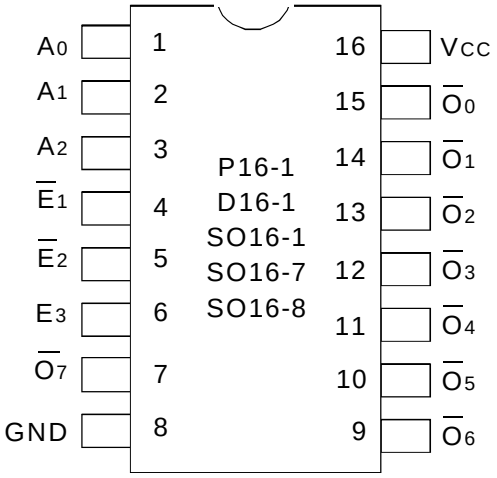
DESCRIPTION:

The IDT54/74FCT138T/AT/CT are 1-of-8 decoders built using an advanced dual metal CMOS technology. The IDT54/74FCT138T/AT/CT accept three binary weighted inputs (A_0, A_1, A_2) and, when enabled, provide eight mutually exclusive active low outputs ($\overline{O}_0$ - $\overline{O}_7$). The IDT54/74FCT138T/AT/CT feature three enable inputs, two active low ($\overline{E}_1$, $\overline{E}_2$) and one active high (E_3). All outputs will be high unless $\overline{E}_1$ and $\overline{E}_2$ are low and E_3 is high. This multiple enable function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four IDT54/74FCT138T/AT/CT devices and one inverter.

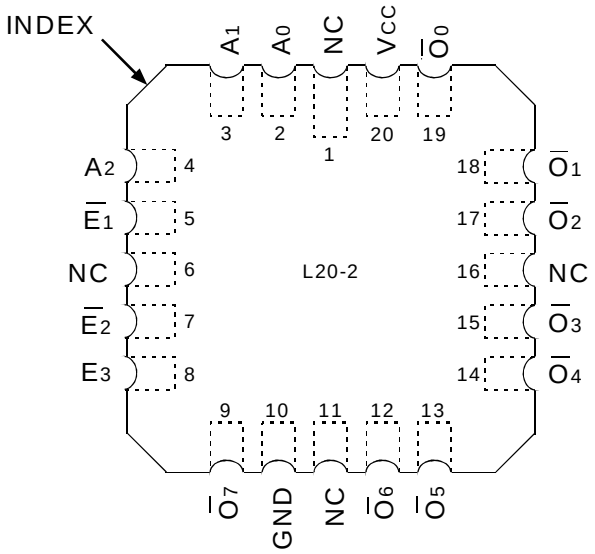
FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



DIP/ SOIC/ QSOP/ CERPACK
TOP VIEW



LCC
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Rating	Max.	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	–0.5 to +7	V
V_{TERM}(3)	Terminal Voltage with Respect to GND	–0.5 to V_{CC}+0.5	V
T_{STG}	Storage Temperature	–65 to +150	°C
I_{OUT}	DC Output Current	–60 to +120	mA

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NOTES:
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. Inputs 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

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

PIN DESCRIPTION

Pin Names	Description
A_0 - A_2	Address Inputs
$\overline{E}_1$, $\overline{E}_2$	Enable Inputs (Active LOW)
E_3	Enable Input (Active HIGH)
$\overline{O}_0$ - $\overline{O}_7$	Outputs (Active LOW)

FUNCTION TABLE(1)

Inputs						Outputs							
$\overline{E}_1$	$\overline{E}_2$	E_3	A_0	A_1	A_2	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$	$\overline{O}_4$	$\overline{O}_5$	$\overline{O}_6$	$\overline{O}_7$
H	X	X	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
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	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	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

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

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Commercial: T_A = – 40°C to +85°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	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
I_{IH}	Input HIGH Current(4)	V_{CC} = Max.	V_I = 2.7V	—	—	±1	µA
I_{IL}	Input LOW Current(4)	V_{CC} = Max.	V_I = 0.5V	—	—	±1	µA
I_I	Input HIGH Current(4)	V_{CC} = Max., V_I = V_{CC} (Max.)		—	—	±1	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	3	—	V
V_{OL}	Output LOW Voltage	V_{CC} = Min. V_{IN} = V_{IH} or V_{IL}	I_{OH} = –32mA MIL I_{OH} = –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}		—	0.01	1	mA

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.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
4. The test limit for this parameter is ±5µA at T_A = -55°C.

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	mA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = Max. Outputs Open One Input Toggling 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	0.15	0.3	mA/ MHz
I_C	Total Power Supply Current [5]	V_{CC} = Max. Outputs Open Toggle $\overline{E}_1$, $\overline{E}_2$, or E_3 50% Duty Cycle fo = 10MHz One Input and One Output Toggling	V_{IN} = V_{CC} V_{IN} = GND	—	1.5	4	mA
			V_{IN} = 3.4V V_{IN} = GND	—	1.8	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.
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. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_o N_o)$
   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 Input Transition Pair (HLH or LHL)
   f_o = Output Frequency
   N_o = Number of Outputs at f_o
   All currents are in milliamps and all frequencies are in megahertz.

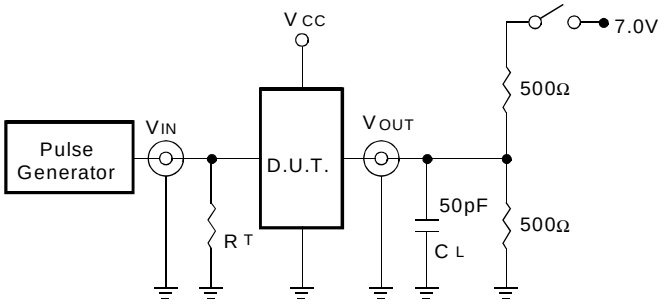
SWITCHING CHARACTERISTICS OVER OPERATING RANGE

			FCT138T				FCT138AT				FCT138CT				
			Com'l.		Mil.		Com'l.		Mil.		Com'l.		Mil.		
Symbol	Parameter	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_N to $\overline{O}_N$	C_L = 50pF R_L = 500Ω	1.5	9	1.5	12	1.5	5.8	1.5	7.8	1.5	5.1	1.5	6	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_N$		1.5	9	1.5	12.5	1.5	5.9	1.5	8	1.5	5.2	1.5	6.1	ns
t_{PLH} t_{PHL}	Propagation Delay E_3 to $\overline{O}_N$		1.5	9	1.5	12.5	1.5	5.9	1.5	8	1.5	5.2	1.5	6.1	ns

NOTES:
1. See test circuit and wave forms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



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SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

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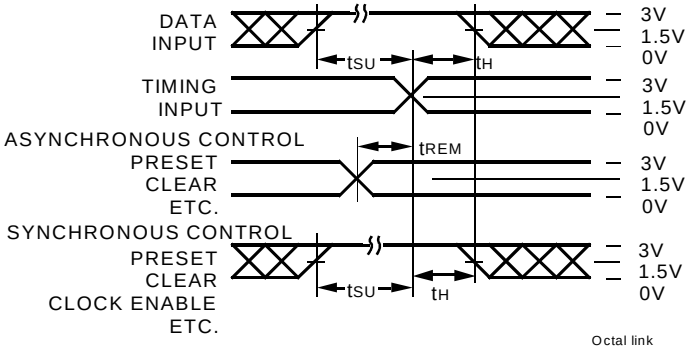
DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.

R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

SET-UP, HOLD, AND RELEASE TIMES



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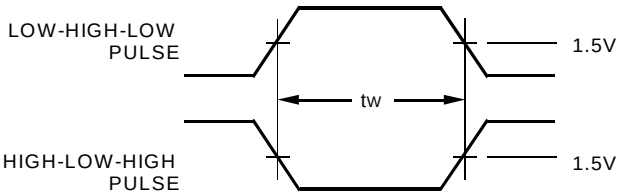
PULSE WIDTH



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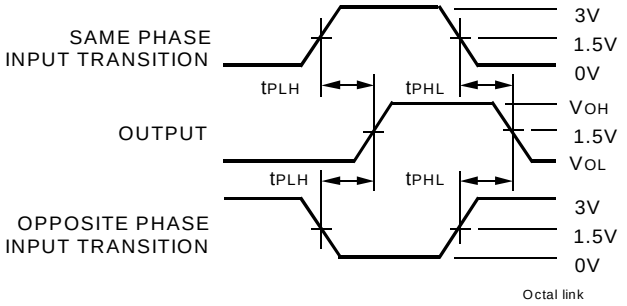
PROPAGATION DELAY



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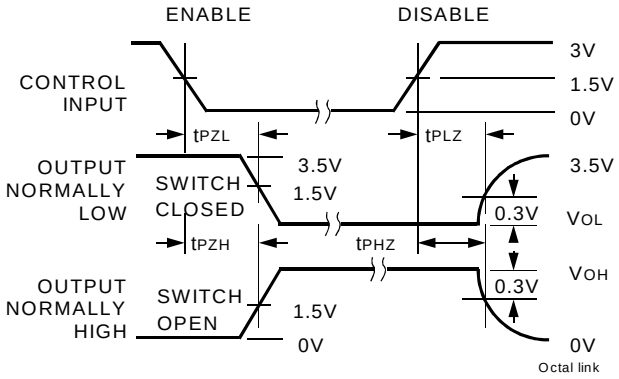
ENABLE AND DISABLE TIMES



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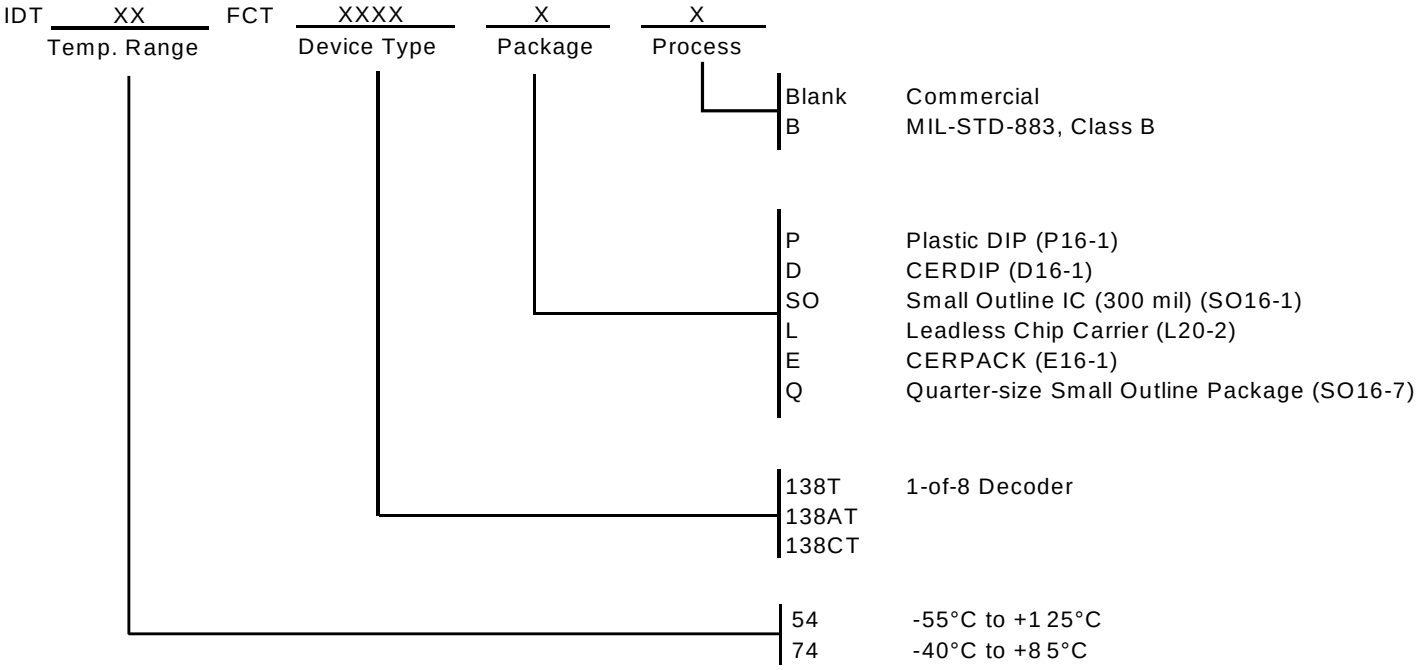
NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

ORDERING INFORMATION



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