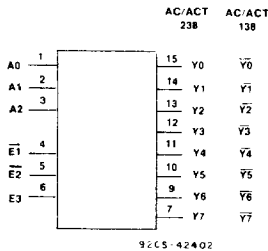


# CD54/74AC138, CD54/74AC238 CD54/74ACT138, CD54/74ACT238



**FUNCTIONAL DIAGRAM & TERMINAL ASSIGNMENT**

## 3-to-8-Line Decoders/Demultiplexers

**AC/ACT138 - Inverting**

**AC/ACT238 - Non-Inverting**

**Type Features:**

- Buffered inputs
- Typical propagation delay (AC/ACT138):  
5 ns @  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{ C}$ ,  $C_L = 50\text{ pF}$

**Family Features:**

- Exceeds 2-kV ESD Protection - MIL-STD-883, Method 3015
- SCR-Latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST\*/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5-V to 5.5-V operation and balanced noise immunity at 30% of the supply.
- $\pm 24\text{-mA}$  output drive current
  - Fanout to 15 FAST\* ICs
  - Drives 50-ohm transmission lines

The RCA-CD54/74AC138 and CD54/74AC238 and the CD54/74ACT138 and CD54/74ACT238 3-to-8-line decoders/demultiplexers use the RCA ADVANCED CMOS technology. Both circuits have three binary select inputs (A0, A1, and A2). If the device is enabled, these inputs determine which one of the eight normally HIGH outputs of the AC/ACT138 will go LOW or which one of the normally LOW outputs of the AC/ACT238 will go HIGH. Two active LOW and one active HIGH enables ( $\bar{E}1$ ,  $\bar{E}2$ , and E3) are provided to simplify the cascading of these devices.

The CD74AC/ACT138 and CD74AC/ACT238 are supplied in 16-lead dual-in-line plastic packages (E suffix) and in 16-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Commercial (0 to 70°C); Industrial (-40 to +85°C); and Extended Industrial/Military (-55 to +125°C).

The CD54AC/ACT138 and CD54AC/ACT238, available in chip form (H suffix), are operable over the -55 to +125°C temperature range.

\*FAST is a Registered Trademark of Fairchild Semiconductor Corp.

**TRUTH TABLE  
CD54/74AC138, CD54/74ACT138**

ENABLE		INPUTS ADDRESS			OUTPUTS							
$E_3$	$\bar{E}_0$	$A_2$	$A_1$	$A_0$	$\bar{Y}_0$	$\bar{Y}_1$	$\bar{Y}_2$	$\bar{Y}_3$	$\bar{Y}_4$	$\bar{Y}_5$	$\bar{Y}_6$	$\bar{Y}_7$
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	L	H	H	H
H	L	H	H	L	H	H	H	H	H	L	H	H
H	L	H	H	H	H	H	H	H	H	H	L	H

H = High level, L = Low level, X = Don't care  
 $\bar{E}_0 = \bar{E}_1 + \bar{E}_2$

# CD54/74AC138, CD54/74AC238 CD54/74ACT138, CD54/74ACT238

TRUTH TABLE  
CD54/74AC238, CD54/74ACT238

ENABLE		INPUTS			OUTPUTS							
		A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>								
E <sub>3</sub>	*E <sub>0</sub>	ADDRESS			Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>	Y <sub>5</sub>	Y <sub>6</sub>	Y <sub>7</sub>
X	H	X	X	X	L	L	L	L	L	L	L	L
L	X	X	X	X	L	L	L	L	L	L	L	L
H	L	L	L	L	H	L	L	L	L	L	L	L
H	L	L	L	H	L	H	L	L	L	L	L	L
H	L	L	H	L	L	L	H	L	L	L	L	L
H	L	L	H	H	L	L	L	H	L	L	L	L
H	L	H	L	L	L	L	L	L	H	L	L	L
H	L	H	L	H	L	L	L	L	L	H	L	L
H	L	H	H	L	L	L	L	L	L	L	H	L
H	L	H	H	H	L	L	L	L	L	L	L	H

H = High level, L = Low level, X = Don't care  
\*E<sub>0</sub> = E<sub>1</sub> + E<sub>2</sub>

**MAXIMUM RATINGS, Absolute-Maximum Values:**

- DC SUPPLY-VOLTAGE (V<sub>CC</sub>) ..... -0.5 to 6 V
- DC INPUT DIODE CURRENT, I<sub>IK</sub> (for V<sub>I</sub> < -0.5 V or V<sub>I</sub> > V<sub>CC</sub> + 0.5 V) ..... ±20 mA
- DC OUTPUT DIODE CURRENT, I<sub>OK</sub> (for V<sub>O</sub> < -0.5 V or V<sub>O</sub> > V<sub>CC</sub> + 0.5 V) ..... ±50 mA
- DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, I<sub>O</sub> (for V<sub>O</sub> > -0.5 V or V<sub>O</sub> < V<sub>CC</sub> + 0.5 V) ..... ±50 mA
- DC V<sub>CC</sub> or GROUND CURRENT (I<sub>CC</sub> or I<sub>GND</sub>) ..... ±100 mA\*
- POWER DISSIPATION PER PACKAGE (P<sub>D</sub>):
  - For T<sub>A</sub> = -55 to +100°C (PACKAGE TYPE E) ..... 500 mW
  - For T<sub>A</sub> = +100 to +125°C (PACKAGE TYPE E) ..... Derate Linearly at 8 mW/°C to 300 mW
  - For T<sub>A</sub> = -55 to +70°C (PACKAGE TYPE M) ..... 400 mW
  - For T<sub>A</sub> = +70 to +125°C (PACKAGE TYPE M) ..... Derate Linearly at 6 mW/°C to 70 mW
- OPERATING-TEMPERATURE RANGE (T<sub>A</sub>) ..... -55 to +125°C
- STORAGE TEMPERATURE (T<sub>stg</sub>) ..... -65 to +150°C
- LEAD TEMPERATURE (DURING SOLDERING):
  - At distance 1/16 ± 1/32 in. (1.59 ± 0.79 mm) from case for 10 s maximum ..... +265°C
  - Unit inserted into PC board min. thickness 1/16 in. (1.59 mm) with solder contacting lead tips only ..... +300°C

\*For up to 4 outputs per device; add ± 25 mA for each additional output.



**RECOMMENDED OPERATING CONDITIONS:**

For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range, V <sub>CC</sub> *: (For T <sub>A</sub> = Full Package-Temperature Range)			
AC Types	1.5	5.5	V
ACT Types	4.5	5.5	V
DC Input or Output Voltage, V <sub>I</sub> , V <sub>O</sub>	0	V <sub>CC</sub>	V
Operating Temperature, T <sub>A</sub>	-55	+125	°C
Input Rise and Fall Slew Rate, dt/dv			
at 1.5 V to 3 V (AC Types)	0	50	ns/V
at 3.6 V to 5.5 V (AC Types)	0	20	ns/V
at 4.5 V to 5.5 V (ACT Types)	0	10	ns/V

\*Unless otherwise specified, all voltages are referenced to ground.

# CD54/74AC138, CD54/74AC238 CD54/74ACT138, CD54/74ACT238

STATIC ELECTRICAL CHARACTERISTICS: AC Series

CHARACTERISTICS	TEST CONDITIONS		V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>a</sub> ) - °C						UNITS	
				+25		-40 to +85		-55 to +125			
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
High-Level Input Voltage V <sub>IH</sub>			1.5	1.2	—	1.2	—	1.2	—	V	
			3	2.1	—	2.1	—	2.1	—		
			5.5	3.85	—	3.85	—	3.85	—		
Low-Level Input Voltage V <sub>IL</sub>			1.5	—	0.3	—	0.3	—	0.3	V	
			3	—	0.9	—	0.9	—	0.9		
			5.5	—	1.65	—	1.65	—	1.65		
High-Level Output Voltage V <sub>OH</sub>	V <sub>IH</sub> or V <sub>IL</sub>		-0.05	1.5	1.4	—	1.4	—	1.4	V	
			-0.05	3	2.9	—	2.9	—	2.9		
			-0.05	4.5	4.4	—	4.4	—	4.4		
	#, *		-4	3	2.58	—	2.48	—	2.4		
			-24	4.5	3.94	—	3.8	—	3.7		
			-75	5.5	—	—	3.85	—	—		
			-50	5.5	—	—	—	—	3.85		
Low-Level Output Voltage V <sub>OL</sub>	V <sub>IH</sub> or V <sub>IL</sub>		0.05	1.5	—	0.1	—	0.1	—	V	
			0.05	3	—	0.1	—	0.1	—		
			0.05	4.5	—	0.1	—	0.1	—		
	#, *		12	3	—	0.36	—	0.44	—		0.5
			24	4.5	—	0.36	—	0.44	—		0.5
			75	5.5	—	—	—	1.65	—		—
			50	5.5	—	—	—	—	—		1.65
Input Leakage Current I <sub>I</sub>	V <sub>CC</sub> or GND		5.5	—	±0.1	—	±1	—	±1	μA	
Quiescent Supply Current, MSI I <sub>CC</sub>	V <sub>CC</sub> or GND	0	5.5	—	8	—	80	—	160	μA	

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

\*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

# CD54/74AC138, CD54/74AC238 CD54/74ACT138, CD54/74ACT238

STATIC ELECTRICAL CHARACTERISTICS: ACT Series

CHARACTERISTICS	TEST CONDITIONS		V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>a</sub> ) - °C						UNITS	
				+25		-40 to +85		-55 to +125			
	V <sub>I</sub> (V)	I <sub>O</sub> (mA)		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
High-Level Input Voltage	V <sub>IH</sub>		4.5 to 5.5	2	—	2	—	2	—	V	
Low-Level Input Voltage	V <sub>IL</sub>		4.5 to 5.5	—	0.8	—	0.8	—	0.8	V	
High-Level Output Voltage	V <sub>OH</sub>	V <sub>IH</sub> or V <sub>IL</sub> #, *	-0.05	4.5	4.4	—	4.4	—	4.4	—	V
			-24	4.5	3.94	—	3.8	—	3.7	—	
			-75	5.5	—	—	3.85	—	—	—	
			-50	5.5	—	—	—	—	3.85	—	
Low-Level Output Voltage	V <sub>OL</sub>	V <sub>IH</sub> or V <sub>IL</sub> #, *	0.05	4.5	—	0.1	—	0.1	—	0.1	V
			24	4.5	—	0.36	—	0.44	—	0.5	
			75	5.5	—	—	—	1.65	—	—	
			50	5.5	—	—	—	—	—	1.65	
Input Leakage Current	I <sub>I</sub>	V <sub>CC</sub> or GND		5.5	—	±0.1	—	±1	—	±1	μA
Quiescent Supply Current, MS1	I <sub>CC</sub>	V <sub>CC</sub> or GND	0	5.5	—	8	—	80	—	160	μA
Additional Quiescent Supply Current per Input Pin TTL Inputs High 1 Unit Load	ΔI <sub>CC</sub>	V <sub>CC</sub> -2.1		4.5 to 5.5	—	2.4	—	2.8	—	3	mA

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

\*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

### ACT INPUT LOADING TABLE

INPUT	UNIT LOAD*
A0 - A2	0.83
E1, E2	1
E3	0.42

\*Unit load is ΔI<sub>CC</sub> limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

# CD54/74AC138, CD54/74AC238 CD54/74ACT138, CD54/74ACT238

SWITCHING CHARACTERISTICS: AC Series;  $t_r, t_f = 3 \text{ ns}$ ,  $C_L = 50 \text{ pF}$

CHARACTERISTICS	SYMBOL	$V_{CC}$ (V)	AMBIENT TEMPERATURE ( $T_A$ ) - °C				UNITS	
			-40 to +85		-55 to +125			
			MIN.	MAX.	MIN.	MAX.		
Propagation Delays: An to Output	(138)	$t_{PLH}$ $t_{PHL}$	1.5	—	125	—	138	ns
			3.3* 5†	4 2.8	14 10	3.9 2.8	15.4 11	
$\overline{E1}, \overline{E2}$ to Output	(138)	$t_{PLH}$ $t_{PHL}$	1.5	—	114	—	125	ns
			3.3 5	3.6 2.6	12.7 9.1	3.5 2.5	14 10	
E3 to Output	(138)	$t_{PLH}$ $t_{PHL}$	1.5	—	125	—	138	ns
			3.3 5	4 2.8	14 10	3.9 2.8	15.4 11	
An to Output	(238)	$t_{PLH}$ $t_{PHL}$	1.5	—	170	—	187	ns
			3.3 5	5.4 3.9	19.1 13.6	5.3 3.8	21 15	
$\overline{E1}, \overline{E2}$ to Output	(238)	$t_{PLH}$ $t_{PHL}$	1.5	—	135	—	149	ns
			3.3 5	4.3 3.1	15.2 10.7	4.2 3	16.7 11.9	
E3 to Output	(238)	$t_{PLH}$ $t_{PHL}$	1.5	—	189	—	208	ns
			3.3 5	6 4.3	21.1 15.1	5.8 4.2	23.2 16.6	
Power Dissipation Capacitance	$C_{PD}‡$	—	110 Typ.		110 Typ.		pF	
Input Capacitance	$C_i$	—	—	10	—	10	pF	

SWITCHING CHARACTERISTICS: ACT Series;  $t_r, t_f = 3 \text{ ns}$ ,  $C_L = 50 \text{ pF}$

CHARACTERISTICS	SYMBOL	$V_{CC}$ (V)	AMBIENT TEMPERATURE ( $T_A$ ) - °C				UNITS	
			-40 to +85		-55 to +125			
			MIN.	MAX.	MIN.	MAX.		
Propagation Delays: An to Output	(138)	$t_{PLH}$ $t_{PHL}$	5†	—	—	—	—	ns
			3.1	10.9	3	12		
$\overline{E1}, \overline{E2}$ to Output	(138)	$t_{PLH}$ $t_{PHL}$	5	—	—	—	—	ns
			2.7	9.5	2.6	10.5		
E3 to Output	(138)	$t_{PLH}$ $t_{PHL}$	5	—	—	—	—	ns
			2.8	10	2.8	11		
An to Output	(238)	$t_{PLH}$ $t_{PHL}$	5	—	—	—	—	ns
			4	14.2	3.9	15.6		
$\overline{E1}, \overline{E2}$ to Output	(238)	$t_{PLH}$ $t_{PHL}$	5	—	—	—	—	ns
			3.7	12.9	3.6	14.2		
E3 to Output	(238)	$t_{PLH}$ $t_{PHL}$	5	—	—	—	—	ns
			3.5	12.4	3.4	13.6		
Power Dissipation Capacitance	$C_{PD}‡$	—	110 Typ.		110 Typ.		pF	
Input Capacitance	$C_i$	—	—	10	—	10	pF	

\*3.3 V: min. is @ 3.6 V  
max. is @ 3 V

†5 V: min. is @ 5.5 V  
max. is @ 4.5 V

‡ $C_{PD}$  is used to determine the dynamic power consumption, per package.

For AC series:  $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$

For ACT series:  $P_D = V_{CC}^2 f_i (C_{PD} + C_L) + V_{CC} \Delta I_{CC}$  where  $f_i$  = input frequency

$C_L$  = output load capacitance

$V_{CC}$  = supply voltage.

# CD54/74AC138, CD54/74AC238 CD54/74ACT138, CD54/74ACT238

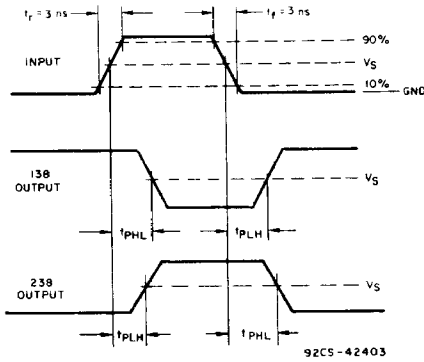


Fig. 1 - Propagation delay times.

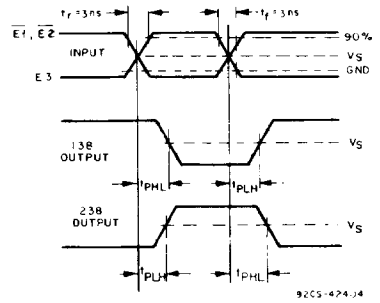


Fig. 2 - Propagation delay times.

	CD54/74AC	CD54/74ACT
Input Level	$V_{CC}$	3 V
Input Switching Voltage, $V_s$	$0.5 V_{CC}$	1.5 V
Output Switching Voltage, $V_s$	$0.5 V_{CC}$	$0.5 V_{CC}$