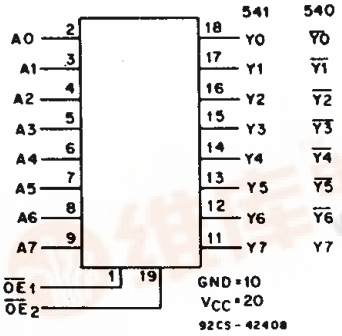
Technical Data

CD54/74AC540, CD54/74AC541
CD54/74ACT540, CD54/74ACT541

Data sheet acquired from Harris Semiconductor
SCHS285A – Revised November 1999



FUNCTIONAL DIAGRAM

Octal Buffer/Line Drivers, 3-State

CD74AC/ACT540 - Inverting
CD74AC/ACT541 - Non-Inverting

Type Features:

- *Buffered inputs*
- *Typical propagation delay: 4.5 ns @ V_{CC} = 5 V, T_A = 25° C, C_L = 50 pF*

The CD54/74AC540, -541, and CD54/74ACT540, -541 octal buffer/line drivers use the RCA ADVANCED CMOS technology. The CD54/74AC/ACT540 are inverting 3-state buffers having two active-LOW output enables. The CD54/74AC/ACT541 are non-inverting 3-state buffers having two active-LOW output enables.

The CD74AC540, -541, and CD74ACT540, -541 are supplied in 20-lead dual-in-line plastic packages (E suffix) and in 20-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Industrial (–40 to +85°C) and Extended Industrial/Military (–55 to +125°C).

The CD54AC540, -541, and CD54ACT540, -541, available in chip form (H suffix), are operable over the –55 to +125°C temperature range.

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.*
- *± 24-mA output drive current*
  - *Fanout to 15 FAST® ICs*
  - *Drives 50-ohm transmission lines*

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TRUTH TABLE

CD54/74AC/ACT540		
INPUTS		OUTPUTS
$\overline{OE1}$, $\overline{OE2}$	A	Y
L	L	H
L	H	L
H	X	Z

TRUTH TABLE

CD54/74AC/ACT541		
INPUTS		OUTPUTS
$\overline{OE1}$, $\overline{OE2}$	A	Y
L	L	L
L	H	H
H	X	Z

H = High Voltage
L = Low Voltage
X = Immaterial
Z = High Impedance

CD54/74AC540, CD54/74AC541
CD54/74ACT540, CD54/74ACT541

MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE (V_{CC}) ..... –0.5 to 6 V
DC INPUT DIODE CURRENT, I_{IK} (for $V_I < -0.5$ or $V_I > V_{CC} + 0.5$ V) ..... ±20 mA
DC OUTPUT DIODE CURRENT, I_{OK} (for $V_O < -0.5$ or $V_O > V_{CC} + 0.5$ V) ..... ±50 mA
DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, I_O (for $V_O > -0.5$ or $V_O < V_{CC} + 0.5$ V) ..... ±50 mA
DC V_{CC} OR GROUND CURRENT (I_{CC} or I_{GND}) ..... ±100 mA*
PACKAGE THERMAL IMPEDANCE, θ_{JA} (see Note 1): E package ..... 69°C/W
M package ..... 58°C/W
STORAGE TEMPERATURE (T_{stg}) ..... –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

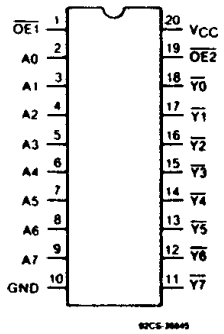
* For up to 4 outputs per device: add ±25 mA for each additional output.
NOTE 1: The package thermal impedance is calculated in accordance with JESD 51.

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

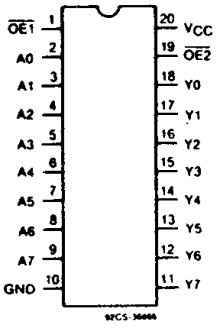
CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range, V_{CC}*: (For T_A = Full Package-Temperature Range)			
AC Types	1.5	5.5	V
ACT Types	4.5	5.5	V
DC Input or Output Voltage, V_I, V_O	0	V_{CC}	V
Operating Temperature, T_A:	-55	+125	°C
Input Rise and Fall Slew Rate, dt/dv			
at 1.5 V to 3 V (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.

TERMINAL ASSIGNMENT DIAGRAMS



CD54/74AC/ACT540



CD54/74AC/ACT541

CD54/74AC540, CD54/74AC541
CD54/74ACT540, CD54/74ACT541

STATIC ELECTRICAL CHARACTERISTICS: AC Series

CHARACTERISTICS	TEST CONDITIONS		V_{CC} (V)	AMBIENT TEMPERATURE (T_A) - °C						UNITS
				+25		-40 to +85		-55 to +125		
	V_I (V)	I_O (mA)		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
High-Level Input Voltage V_{IH}			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_{IL}			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_{OH}	V_{IH} or V_{IL}	-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_{OL}	V_{IH} or V_{IL}	0.05	1.5	—	0.1	—	0.1	—	0.1	V
		0.05	3	—	0.1	—	0.1	—	0.1	
		0.05	4.5	—	0.1	—	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_I	V_{CC} or GND		5.5	—	±0.1	—	±1	—	±1	μA
3-State Leakage Current I_{OZ}	V_{IH} or V_{IL} V_O = V_{CC} or GND		5.5	—	±0.5	—	±5	—	±10	μA
Quiescent Supply Current, MSI I_{CC}	V_{CC} 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.

CD54/74AC540, CD54/74AC541
CD54/74ACT540, CD54/74ACT541

STATIC ELECTRICAL CHARACTERISTICS: ACT Series

CHARACTERISTICS	TEST CONDITIONS		V_{CC} (V)	AMBIENT TEMPERATURE (T_A) - °C						UNITS
				+25		-40 to +85		-55 to +125		
	V_I (V)	I_O (mA)		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
High-Level Input Voltage V_{IH}			4.5 to 5.5	2	—	2	—	2	—	V
Low-Level Input Voltage V_{IL}			4.5 to 5.5	—	0.8	—	0.8	—	0.8	V
High-Level Output Voltage V_{OH}	V_{IH} or V_{IL}	-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_{OL}	V_{IH} or V_{IL}	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_I	V_{CC} or GND		5.5	—	±0.1	—	±1	—	±1	μA
3-State Leakage Current I_{OZ}	V_{IH} or V_{IL} V_O = V_{CC} or GND		5.5	—	±0.5	—	±5	—	±10	μA
Quiescent Supply Current, MSI I_{CC}	V_{CC} or GND	0	5.5	—	8	—	80	—	160	μA
Additional Quiescent Supply Current per Input Pin TTL Inputs High 1 Unit Load ΔI_{CC}	V_{CC}-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*	
	540	541
DATA	1.42	0.5
$\overline{OE1}$, $\overline{OE2}$	1.3	1.3

*Unit load is ΔI_{CC} limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

CD54/74AC540, CD54/74AC541
CD54/74ACT540, CD54/74ACT541

SWITCHING CHARACTERISTICS: AC Series; t_r, t_f = 3 ns, C_L = 50 pF

CHARACTERISTICS	SYMBOL	V_{CC} (V)	AMBIENT TEMPERATURE (T_A) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: Data to Output AC540	t_{PLH} t_{PHL}	1.5	—	77	—	85	ns
		3.3*	2.4	8.6	2.4	9.5	
		5†	1.8	6.2	1.7	6.8	
AC541	t_{PLH} t_{PHL}	1.5	—	89	—	98	ns
		3.3	2.8	9.9	2.7	10.9	
		5	2.1	7.1	2	7.8	
Enable, to Output to Output	t_{PZL} t_{PZH}	1.5	—	136	—	150	ns
		3.3	4.6	16.4	4.5	18	
		5	3.1	10.9	3	12	
Disable to Output to Output	t_{PLZ} t_{PHZ}	1.5	—	136	—	150	ns
		3.3	3.9	13.6	3.8	15	
		5	3.1	10.9	3	12	
Power Dissipation Capacitance AC540 AC541	C_{PD}‡	—	60 Typ.		60 Typ.		pF
		—	60 Typ.		60 Typ.		
Min. (Valley) V_{OH} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OHV} See Fig. 1	5	4 Typ. @ 25°C				V
Max. (Peak) V_{OL} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OLP} See Fig. 1	5	1 Typ. @ 25°C				V
Input Capacitance	C_I	—	—	10	—	10	pF
3-State Output Capacitance	C_O	—	—	15	—	15	pF

SWITCHING CHARACTERISTICS: ACT Series; t_r, t_f = 3 ns, C_L = 50 pF

CHARACTERISTICS	SYMBOL	V_{CC} (V)	AMBIENT TEMPERATURE (T_A) - °C				UNITS
			-40 to +85		-55 to =125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: Data to Output ACT540	t_{PLH} t_{PHL}	5†	1.9	6.5	1.8	7.2	ns
ACT541	t_{PLH} t_{PHL}	5†	2.1	7.5	2.1	8.2	ns
Enable to Output	t_{PZL} t_{PZH}	5	3.5	12.2	3.4	13.4	ns
Disable to Output	t_{PLZ} t_{PHZ}	5	3.5	12.2	3.4	13.4	ns
Power Dissipation Capacitance ACT540 ACT541	C_{PD}§	—	60 Typ.		60 Typ.		pF
		—	60 Typ.		60 Typ.		
Min. (Valley) V_{OH} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OHV} See Fig. 1	5	4 Typ. @ 25°C				V
Max. (Peak) V_{OL} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OLP} See Fig. 1	5	1 Typ. @ 25°C				V
Input Capacitance	C_I	—	—	10	—	10	pF
3-State Output Capacitance	C_O	—	—	15	—	15	pF

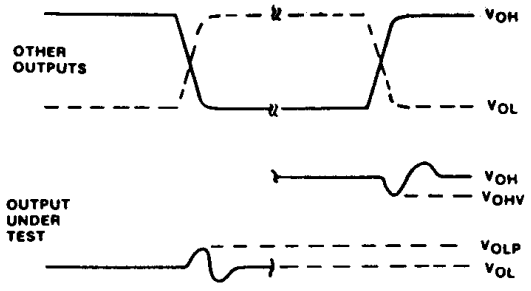
*3.3 V: min. is @ 3.6 V
max. is @ 3 V

†5 V: min. is @ 5.5 V
max. is @ 4.5 V

§C_{PD} is used to determine the dynamic power consumption, per channel.
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.

CD54/74AC540, CD54/74AC541
CD54/74ACT540, CD54/74ACT541

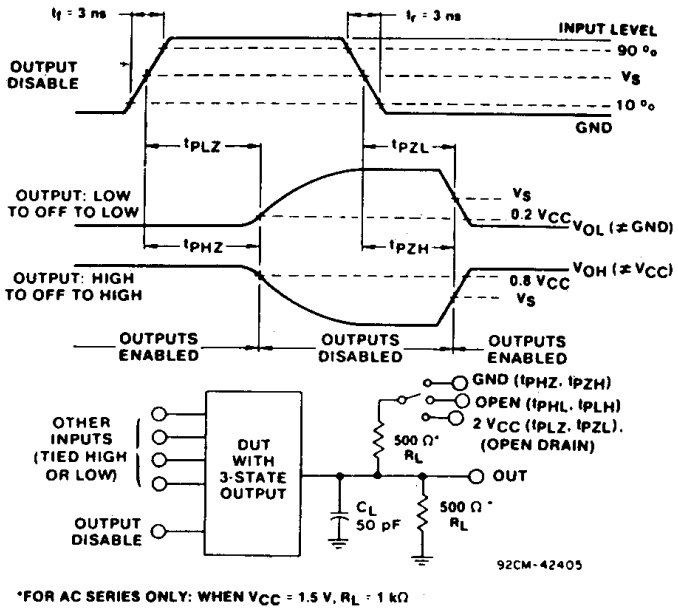
PARAMETER MEASUREMENT INFORMATION



NOTES:
1. V_{OHV} AND V_{OLP} ARE MEASURED WITH RESPECT TO A GROUND REFERENCE NEAR THE OUTPUT UNDER TEST.
2. INPUT PULSES HAVE THE FOLLOWING CHARACTERISTICS: PRR ≤ 1 MHz, t_r = 3 ns, t_f = 3 ns, SKEW 1 ns.
3. R.F. FIXTURE WITH 700-MHz DESIGN RULES REQUIRED. IC SHOULD BE SOLDERED INTO TEST BOARD AND BYPASSED WITH 0.1 μF CAPACITOR. SCOPE AND PROBES REQUIRE 700-MHz BANDWIDTH.

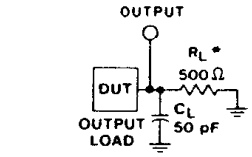
92CS-42406

Fig. 1 - Simultaneous switching transient waveforms.



*FOR AC SERIES ONLY: WHEN V_{CC} = 1.5 V, R_L = 1 kΩ

Fig. 2 - Three-state propagation delay waveforms and test circuit.



*FOR AC SERIES ONLY: WHEN V_{CC} = 1.5 V, R_L = 1 kΩ

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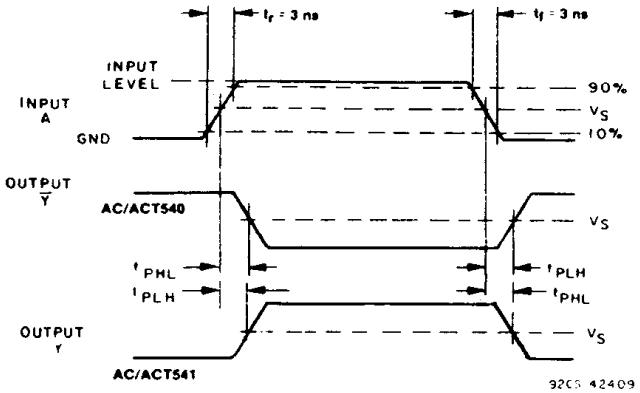

Fig. 3 - Propagation delay times and test circuit.

	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}

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