

# CD74HC4351, CD74HCT4351, CD74HC4352

## High Speed CMOS Logic Analog Multiplexers/Demultiplexers with Latch

### Features

- Wide Analog Input Voltage Range . . . . .  $\pm 5V$  (Max)
- Low "On" Resistance
  - $V_{CC} - V_{EE} = 4.5V$  . . . . .  $70\Omega$  (Typ)
  - $V_{CC} - V_{EE} = 9V$  . . . . .  $40\Omega$  (Typ)
- Low Crosstalk Between Switches
- Fast Switching and Propagation Speeds
- "Break-Before-Make" Switching
- Wide Operating Temperature Range . . .  $-55^{\circ}C$  to  $125^{\circ}C$
- HC Types
  - 2V to 6V Operation, Control; 0V to 10V Switch
  - High Noise Immunity:  $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$  at  $V_{CC} = 5V$
- HCT Types
  - 4.5V to 5.5V Operation, Control; 0V to 10V Switch
  - Direct LSTTL Input Logic Compatibility,  $V_{IL} = 0.8V$  (Max),  $V_{IH} = 2V$  (Min)
  - CMOS Input Compatibility,  $I_I \leq 1\mu A$  at  $V_{OL}$ ,  $V_{OH}$

### Description

The Harris CD74HC4351, CD74HCT4351 and CD74HC4352 are digitally controlled analog switches which utilize silicon-gate CMOS technology to achieve operating speeds similar to LSTTL with the low power consumption of standard CMOS integrated circuits.

These analog multiplexers/demultiplexers are, in essence, the HC/HCT4015 and HC4052 preceded by address latches that are controlled by an active low Latch Enable input ( $\overline{LE}$ ). Two Enable inputs, one active low ( $\overline{E1}$ ), and the other active high (E2) are provided allowing enabling with either input voltage level.

### Ordering Information

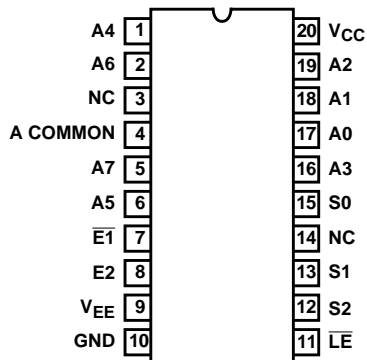
PART NUMBER	TEMP. RANGE ( $^{\circ}C$ )	PACKAGE	PKG. NO.
CD74HC4351E	-55 to 125	20 Ld PDIP	E20.3
CD74HCT4351E	-55 to 125	20 Ld PDIP	E20.3
CD74HC4352E	-55 to 125	20 Ld PDIP	E20.3
CD74HC4351M	-55 to 125	20 Ld SOIC	M20.15

#### NOTES:

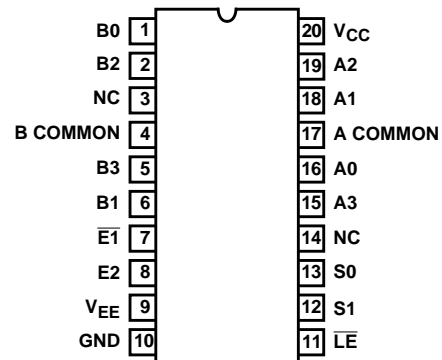
1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer and die for this part number is available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

### Pinouts

CD74HC4351, CD74HCT4351  
(PDIP, SOIC)  
TOP VIEW

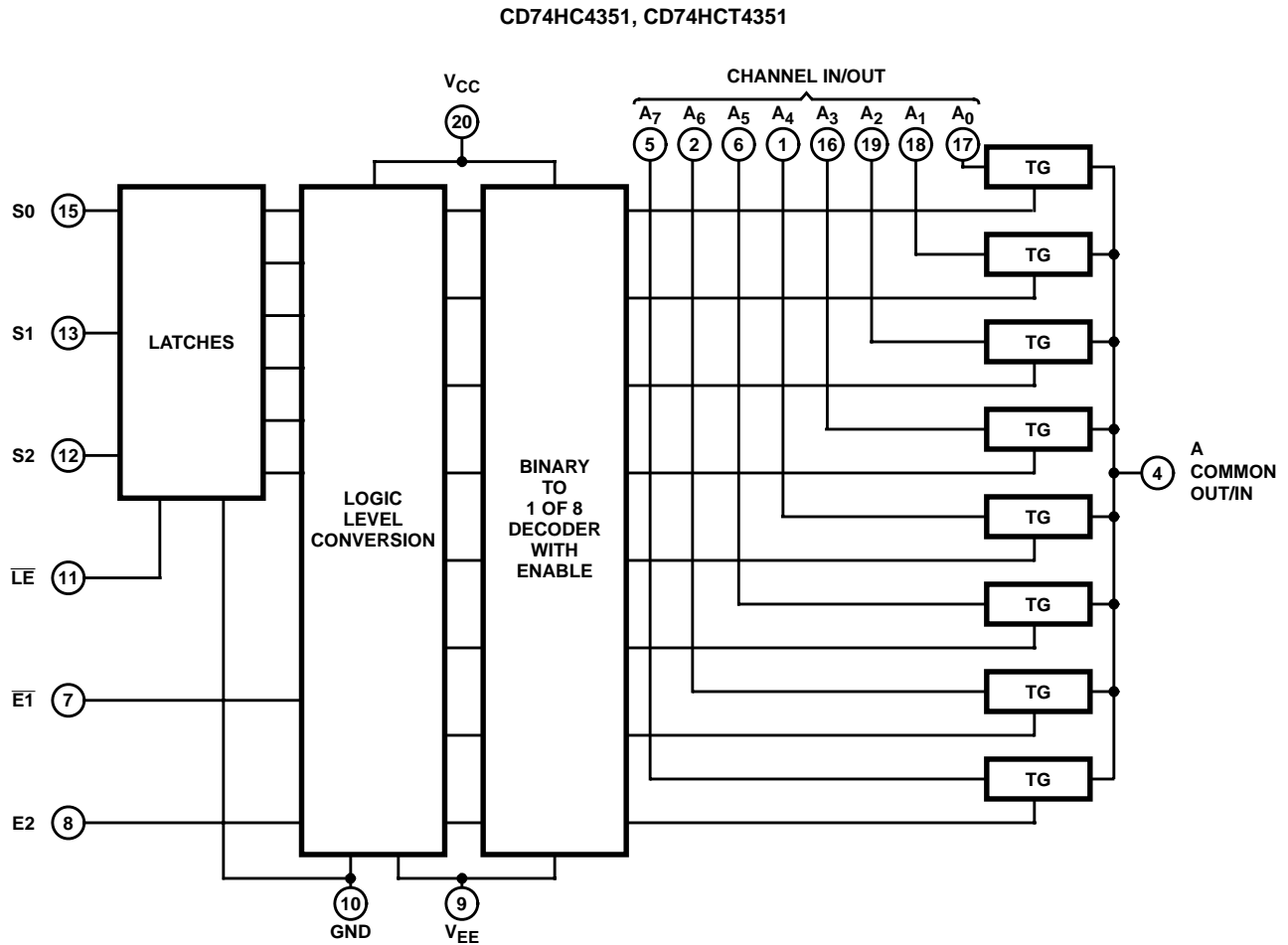


CD74HC4352  
(PDIP)  
TOP VIEW



CD74HC4351, CD74HCT4351, CD74HC4352

Functional Diagram



TRUTH TABLE  
CD74HC4351, CD74HCT4351

INPUT STATES					(NOTE 3) "ON" SWITCHES $\overline{LE} = H$
$\overline{E1}$	E2	S2	S1	S0	
L	H	L	L	L	A <sub>0</sub>
L	H	L	L	H	A <sub>1</sub>
L	H	L	H	L	A <sub>2</sub>
L	H	L	H	H	A <sub>3</sub>
L	H	H	L	L	A <sub>4</sub>
L	H	H	L	H	A <sub>5</sub>
L	H	H	H	L	A <sub>6</sub>
L	H	H	H	H	A <sub>7</sub>
H	L	X	X	X	None

NOTE:

- 3. When  $\overline{LE}$  is low S0-S2 data are latched and switches cannot change state.  
H = High Voltage Level, L = Low Voltage Level, X = Don't Care

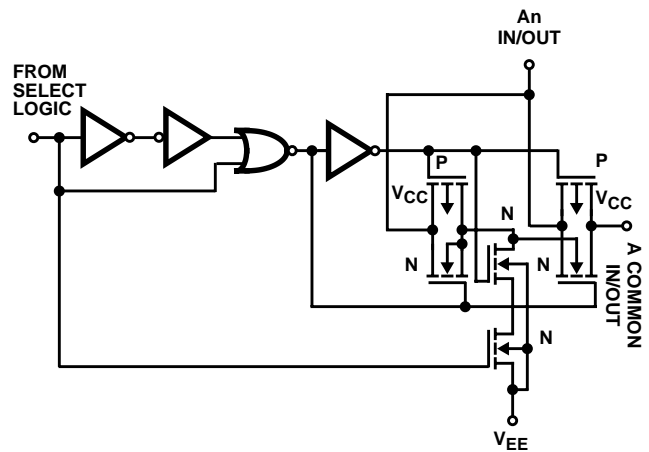
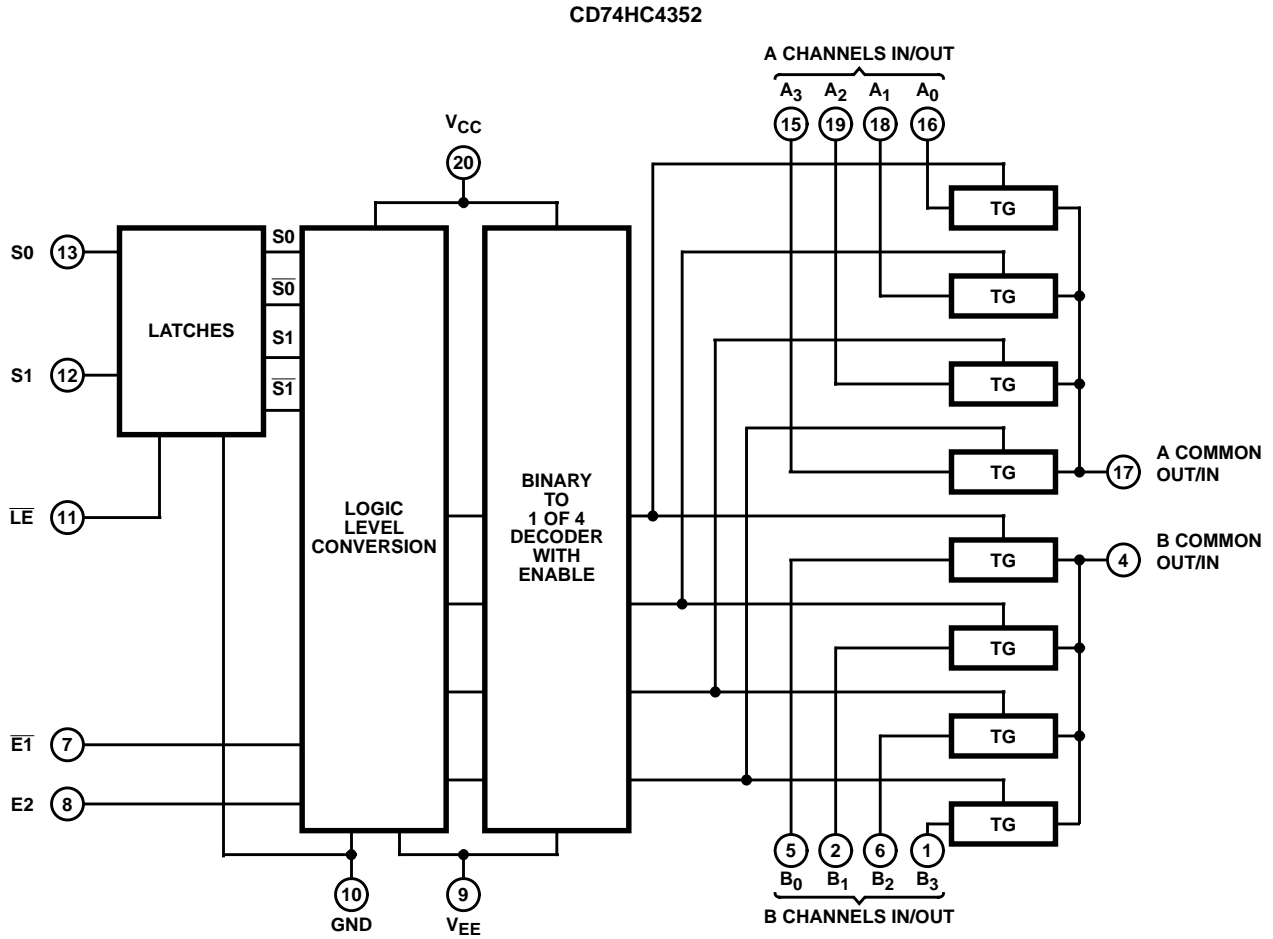


FIGURE 1. DETAIL OF ONE HC/HCT4351 SWITCH

Functional Diagram



TRUTH TABLE  
CD74HC4352

INPUT STATES				(NOTE 4) "ON" SWITCHES $\overline{LE} = H$
$\overline{E1}$	E2	S1	S0	
L	H	L	L	A <sub>0</sub> , B <sub>0</sub>
L	H	L	H	A <sub>1</sub> , B <sub>1</sub>
L	H	H	L	A <sub>2</sub> , B <sub>2</sub>
L	H	H	H	A <sub>3</sub> , B <sub>3</sub>
H	L	X	X	None

NOTE:

- 4. When Latch Enable is "Low" channel-select data is latched and switches cannot change state.  
H = High Voltage Level, L = Low Voltage Level, X = Don't Care

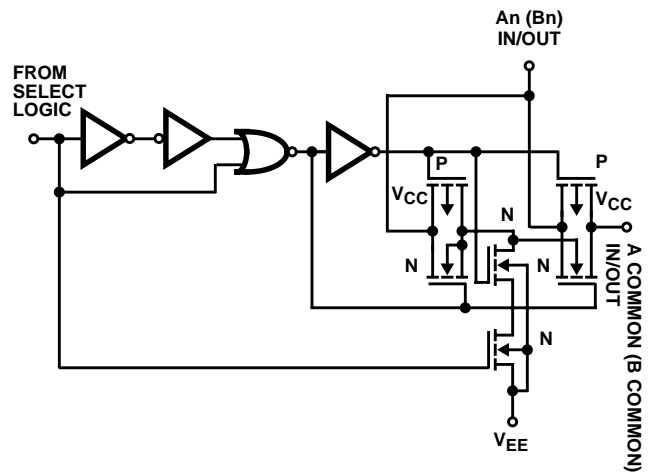


FIGURE 2. DETAIL OF ONE CD74HC4352 SWITCH

# CD74HC4351, CD74HCT4351, CD74HC4352

## Absolute Maximum Ratings

DC Supply Voltage, $V_{CC}$ .....	-0.5V to 7V
DC Supply Voltage, $V_{CC} - V_{EE}$ .....	-0.5V to 10.5V
DC Supply Voltage, $V_{EE}$ .....	0.5V to -7V
DC Input Diode Current, $I_{IK}$ For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ .....	$\pm 20mA$
DC Switch Diode Current, $I_{OK}$ For $V_I < V_{EE} - 0.5V$ or $V_I < V_{CC} + 0.5V$ .....	$\pm 25mA$
DC Switch Current, $I_{OK}$ (Note 5) For $V_I > V_{EE} - 0.5V$ or $V_I < V_{CC} + 0.5V$ .....	$\pm 20mA$
DC Output Diode Current, $I_{OK}$ For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ .....	$\pm 20mA$
DC Output Source or Sink Current per Output Pin, $I_O$ For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ .....	$\pm 25mA$
DC $V_{CC}$ or Ground Current, $I_{CC}$ .....	$\pm 50mA$

## Operating Conditions

Temperature Range, $T_A$ .....	-55°C to 125°C
Supply Voltage Range, $V_{CC}$ HC Types .....	.2V to 6V
HCT Types .....	4.5V to 5.5V
Supply Voltage Range, $V_{CC} - V_{EE}$ HC, HCT Types (Figure 3) .....	.2V to 10V
Supply Voltage Range, $V_{EE}$ HC, HCT Types (Figure 4) .....	0V to -6V
DC Input or Output Voltage, $V_I$ .....	GND to $V_{CC}$
Analog Switch I/O Voltage, $V_{IS}$ .....	$V_{EE}$ (Min) ..... $V_{CC}$ (Max)
Input Rise and Fall Time, $t_r, t_f$ 2V .....	1000ns (Max)
4.5V .....	500ns (Max)
6V .....	400ns (Max)

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTES:

- In certain applications, the external load-resistor current may include both  $V_{CC}$  and signal-line components. To avoid drawing  $V_{CC}$  current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.6V (calculated from  $R_{ON}$  values shown in the DC Electrical Specifications table). No  $V_{CC}$  current will flow through  $R_L$  if the switch current flows into terminal 3 on the HC/HCT4351; terminals 3 and 13 on the HC4352.
- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Thermal Information

Thermal Resistance (Typical, Note 6)	$\theta_{JA}$ (°C/W)
PDIP Package .....	125
SOIC Package .....	120
Maximum Junction Temperature .....	150°C
Maximum Storage Temperature Range .....	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s) .....	300°C (SOIC - Lead Tips Only)

## Recommended Operating Area as a Function of Supply Voltage

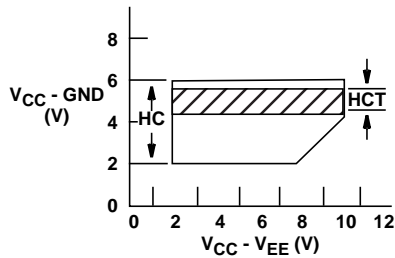


FIGURE 3.

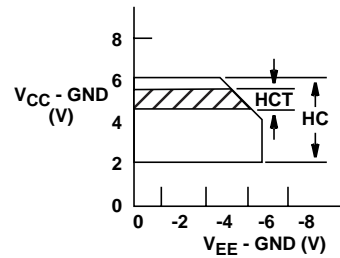


FIGURE 4.

**CD74HC4351, CD74HCT4351, CD74HC4352**

**DC Electrical Specifications**

PARAMETER	SYMBOL	TEST CONDITIONS				25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS	
		V <sub>I</sub> (V)	V <sub>IS</sub> (V)	V <sub>EE</sub> (V)	V <sub>CC</sub> (V)	MIN	TYP	MAX	MIN	MAX	MIN	MAX		
<b>HC TYPES</b>														
High Level Input Voltage	V <sub>IH</sub>	-	-	-	2	1.5	-	-	1.5	-	1.5	-	V	
					4.5	3.15	-	-	3.15	-	3.15	-	V	
					6	4.2	-	-	4.2	-	4.2	-	V	
Low Level Input Voltage	V <sub>IL</sub>	-	-	-	2	-	-	0.5	-	0.5	-	0.5	V	
					4.5	-	-	1.35	-	1.35	-	1.35	V	
					6	-	-	1.8	-	1.8	-	1.8	V	
"ON" Resistance I <sub>O</sub> = 1mA Figure 9	R <sub>ON</sub>	V <sub>IH</sub> or V <sub>IL</sub>	V <sub>CC</sub> or V <sub>EE</sub>	0	4.5	-	70	160	-	200	-	240	Ω	
				0	6	-	60	140	-	175	-	210	Ω	
				-4.5	4.5	-	40	120	-	150	-	180	Ω	
			V <sub>CC</sub> to V <sub>EE</sub>	0	4.5	-	90	180	-	225	-	270	Ω	
				0	6	-	80	160	-	200	-	240	Ω	
				-4.5	4.5	-	45	130	-	162	-	195	Ω	
Maximum "ON" Resistance Between Any Two Channels	ΔR <sub>ON</sub>	-	-	0	4.5	-	10	-	-	-	-	-	Ω	
				0	6	-	8.5	-	-	-	-	-	Ω	
				-4.5	4.5	-	5	-	-	-	-	-	Ω	
Switch On/Off Leakage Current 4 Channels (4352)	I <sub>IZ</sub>	V <sub>IH</sub> or V <sub>IL</sub>	For Switch OFF: When V <sub>IS</sub> = V <sub>CC</sub> V <sub>OS</sub> = V <sub>EE</sub> ; When V <sub>IS</sub> = V <sub>EE</sub> ; V <sub>OS</sub> = V <sub>CC</sub> For Switch ON: All Applicable Combinations of V <sub>IS</sub> and V <sub>OS</sub> Voltage Levels	0	6	-	-	±0.1	-	±1	-	±1	μA	
				-5	5	-	-	±0.2	-	±2	-	±2	μA	
Switch On/Off Leakage Current 8 Channels (4351)	I <sub>IZ</sub>	V <sub>IH</sub> or V <sub>IL</sub>		0	6	-	-	±0.2	-	±2	-	±2	μA	
				-5	5	-	-	±0.4	-	±4	-	±4	μA	
Control Input Leakage Current	I <sub>IL</sub>	V <sub>CC</sub> or GND		-	0	6	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current I <sub>O</sub> = 0	I <sub>CC</sub>	V <sub>CC</sub> or GND		When V <sub>IS</sub> = V <sub>EE</sub> ; V <sub>OS</sub> = V <sub>CC</sub> ; When V <sub>IS</sub> = V <sub>CC</sub> ; V <sub>OS</sub> = V <sub>EE</sub>	0	6	-	-	8	-	80	-	160	μA
			-5		5	-	-	16	-	160	-	320	μA	

**CD74HC4351, CD74HCT4351, CD74HC4352**

**DC Electrical Specifications (Continued)**

PARAMETER	SYMBOL	TEST CONDITIONS				25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V <sub>I</sub> (V)	V <sub>IS</sub> (V)	V <sub>EE</sub> (V)	V <sub>CC</sub> (V)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	
<b>HCT TYPES</b>													
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
“ON” Resistance I <sub>O</sub> = 1mA Figure 9	R <sub>ON</sub>	V <sub>IH</sub> or V <sub>IL</sub>	V <sub>CC</sub> or V <sub>EE</sub>	0	4.5	-	70	160	-	200	-	240	Ω
				-4.5	4.5	-	40	120	-	150	-	180	Ω
		V <sub>CC</sub> to V <sub>EE</sub>	0	4.5	-	90	180	-	225	-	270	Ω	
			-4.5	4.5	-	45	130	-	162	-	195	Ω	
Maximum “ON” Resistance Between Any Two Channels	ΔR <sub>ON</sub>	-	-	0	4.5	-	10	-	-	-	-	-	Ω
				-4.5	4.5	-	5	-	-	-	-	-	-
Switch On/Off Leakage Current 4 Channels (4352)	I <sub>IZ</sub>	V <sub>IH</sub> or V <sub>IL</sub>	For Switch OFF: When V <sub>IS</sub> = V <sub>CC</sub> V <sub>OS</sub> = V <sub>EE</sub> ; When V <sub>IS</sub> = V <sub>EE</sub> , V <sub>OS</sub> = V <sub>CC</sub> For Switch ON: All Applicable Combinations of V <sub>IS</sub> and V <sub>OS</sub> Voltage Levels	0	6	-	-	±0.1	-	±1	-	±1	μA
-5				5	-	-	±0.2	-	±2	-	±2	μA	
0				6	-	-	±0.2	-	±2	-	±2	μA	
-5				5	-	-	±0.4	-	±4	-	±4	μA	
Switch On/Off Leakage Current 8 Channels (4351)													
Control Input Leakage Current	I <sub>I</sub>	V <sub>CC</sub> or GND	-	0	5.5	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current I <sub>O</sub> = 0	I <sub>CC</sub>	Any Voltage Between V <sub>CC</sub> and GND	When V <sub>IS</sub> = V <sub>EE</sub> , V <sub>OS</sub> = V <sub>CC</sub> ; When V <sub>IS</sub> = V <sub>CC</sub> , V <sub>OS</sub> = V <sub>EE</sub>	0	5.5	-	-	8	-	80	-	160	μA
				-4.5	5.5	-	-	16	-	160	-	320	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	ΔI <sub>CC</sub>	V <sub>CC</sub> -2.1	-	-	4.5 to 5.5	-	100	360	-	450	-	490	μA

NOTE: For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4V, V<sub>CC</sub> = 5.5V) specification is 1.8mA.

**HCT Input Loading Table**

TYPE	INPUT	UNIT LOADS
All	$\bar{E}1, E2, S_n$	0.5
(4351, 4352)	$\bar{L}E$	1.5

NOTE: Unit Load is ΔI<sub>CC</sub> limit specified in DC Electrical Table, e.g., 360μA max at 25°C.

**CD74HC4351, CD74HCT4351, CD74HC4352**

**Switching Specifications** Input  $t_r, t_f = 6\text{ns}$

PARAMETER	SYMBOL	TEST CONDITIONS	$V_{EE}$ (V)	$V_{CC}$ (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
					MIN	TYP	MAX	MIN	MAX	MIN	MAX	
<b>HC TYPES</b>												
Propagation Delay, Switch In to Switch Out	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	0	2	-	-	35	-	45	-	55	ns
			0	4.5	-	-	7	-	9	-	11	ns
			0	6	-	-	6	-	8	-	9	ns
			-4.5	4.5	-	-	5	-	7	-	8	ns
Maximum Switch Turn "ON" Delay 4351 $\bar{E}1, E2, \bar{L}E$ to $V_{OS}$	$t_{PZH}, t_{PZL}$	$C_L = 50\text{pF}$	0	2	-	-	300	-	375	-	450	ns
			0	4.5	-	-	60	-	75	-	90	ns
			0	6	-	-	51	-	64	-	77	ns
			-4.5	4.5	-	-	55	-	69	-	83	ns
		$C_L = 15\text{pF}$	-	5	-	27	-	-	-	-	-	ns
Maximum Switch Turn "ON" Delay 4352 $\bar{E}1, E2, \bar{L}E$ to $V_{OS}$	$t_{PZH}, t_{PZL}$	$C_L = 50\text{pF}$	0	2	-	-	350	-	440	-	525	ns
			0	4.5	-	-	70	-	88	-	105	ns
			0	6	-	-	60	-	75	-	90	ns
			-4.5	4.5	-	-	60	-	75	-	90	ns
		$C_L = 15\text{pF}$	-	5	-	35	-	-	-	-	-	ns
Maximum Switch Turn "ON" Delay 4351 $S_n$ to $V_{OS}$	$t_{PZH}, t_{PZL}$	$C_L = 50\text{pF}$	0	2	-	-	300	-	375	-	450	ns
			0	4.5	-	-	60	-	75	-	90	ns
			0	6	-	-	51	-	64	-	77	ns
			-4.5	4.5	-	-	50	-	63	-	75	ns
		$C_L = 15\text{pF}$	-	5	-	27	-	-	-	-	-	ns
Maximum Switch Turn "ON" Delay 4352 $S_n$ to $V_{OS}$	$t_{PZH}, t_{PZL}$	$C_L = 50\text{pF}$	0	2	-	-	375	-	470	-	565	ns
			0	4.5	-	-	75	-	94	-	113	ns
			0	6	-	-	64	-	80	-	96	ns
			-4.5	4.5	-	-	55	-	69	-	83	ns
		$C_L = 15\text{pF}$	-	5	-	35	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 $\bar{E}1$ to $V_{OS}$	$t_{PHZ}, t_{PLZ}$	$C_L = 50\text{pF}$	0	2	-	-	250	-	315	-	375	ns
			0	4.5	-	-	50	-	63	-	75	ns
			0	6	-	-	43	-	54	-	64	ns
			-4.5	4.5	-	-	40	-	50	-	60	ns
		$C_L = 15\text{pF}$	-	5	-	21	-	-	-	-	-	ns

**CD74HC4351, CD74HCT4351, CD74HC4352**

**Switching Specifications** Input  $t_r, t_f = 6\text{ns}$  (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V <sub>EE</sub> (V)	V <sub>CC</sub> (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
					MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Maximum Switch Turn "OFF" Delay 4351 E2 to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	2	-	-	250	-	315	-	375	ns
			0	4.5	-	-	50	-	63	-	75	ns
			0	6	-	-	43	-	54	-	64	ns
			-4.5	4.5	-	-	40	-	50	-	60	ns
		C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 LE to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	2	-	-	275	-	345	-	415	ns
			0	4.5	-	-	55	-	69	-	83	ns
			0	6	-	-	47	-	59	-	71	ns
			-4.5	4.5	-	-	45	-	56	-	68	ns
		C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 Sn to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	2	-	-	275	-	345	-	415	ns
			0	4.5	-	-	55	-	69	-	83	ns
			0	6	-	-	47	-	59	-	71	ns
			-4.5	4.5	-	-	48	-	60	-	71	ns
		C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4352 E1, E2, LE to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	2	-	-	275	-	345	-	415	ns
			0	4.5	-	-	55	-	69	-	83	ns
			0	6	-	-	47	-	59	-	71	ns
			-4.5	4.5	-	-	50	-	63	-	75	ns
		C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-	ns
Setup Time 4351 Sn to LE	t <sub>SU</sub>	C <sub>L</sub> = 50pF	0	2	-	-	60	-	75	-	90	ns
			0	4.5	-	-	12	-	15	-	18	ns
			0	6	-	-	10	-	13	-	15	ns
			-4.5	4.5	-	-	18	-	23	-	27	ns
			C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-
Hold Time 4351 and 4352 Sn to LE	t <sub>H</sub>	C <sub>L</sub> = 50pF	0	2	5	-	-	5	-	5	-	ns
			0	4.5	5	-	-	5	-	5	-	ns
			0	6	5	-	-	5	-	5	-	ns
			-4.5	4.5	5	-	-	5	-	5	-	ns
			C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-
Pulse Width 4351 and 4352 LE	t <sub>W</sub>	C <sub>L</sub> = 50pF	0	2	100	-	-	125	-	150	-	ns
			0	4.5	20	-	-	25	-	30	-	ns
			0	6	17	-	-	21	-	26	-	ns
			-4.5	4.5	25	-	-	31	-	38	-	ns
			C <sub>L</sub> = 15pF	-	5	-	21	-	-	-	-	-
Input (Control) Capacitance	C <sub>I</sub>	-	-	-	-	10	-	10	-	10	pF	
Power Dissipation Capacitance (Notes 7, 8) 4351	C <sub>PD</sub>	-	-	5	-	50	-	-	-	-	pF	



**CD74HC4351, CD74HCT4351, CD74HC4352**

**Switching Specifications** Input  $t_r$ ,  $t_f = 6\text{ns}$  (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V <sub>EE</sub> (V)	V <sub>CC</sub> (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
					MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Power Dissipation Capacitance (Notes 7, 8) 4352	C <sub>PD</sub>	-	-	5	-	74	-	-	-	-	-	pF
<b>HCT TYPES</b>												
Propagation Delay, Switch In to Switch Out	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	7	-	9	-	11	ns
			-4.5	4.5	-	-	5	-	7	-	8	ns
Maximum Switch Turn "ON" Delay 4351 E1, E2, LE to V <sub>OS</sub>	t <sub>PZH</sub> , t <sub>PZL</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	75	-	94	-	113	ns
			-4.5	4.5	-	-	60	-	75	-	90	ns
		C <sub>L</sub> = 15pF	-	5	-	35	-	-	-	-	-	ns
Maximum Switch Turn "ON" Delay 4351 Sn to V <sub>OS</sub>	t <sub>PZH</sub> , t <sub>PZL</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	75	-	94	-	113	ns
			-4.5	4.5	-	-	60	-	75	-	90	ns
		C <sub>L</sub> = 15pF	-	5	-	35	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 E1 to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	55	-	69	-	83	ns
			-4.5	4.5	-	-	40	-	50	-	60	ns
		C <sub>L</sub> = 15pF	-	5	-	23	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 E2 to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	60	-	75	-	90	ns
			-4.5	4.5	-	-	50	-	63	-	75	ns
		C <sub>L</sub> = 15pF	-	5	-	23	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 LE to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	60	-	75	-	90	ns
			-4.5	4.5	-	-	55	-	69	-	83	ns
		C <sub>L</sub> = 15pF	-	5	-	23	-	-	-	-	-	ns
Maximum Switch Turn "OFF" Delay 4351 Sn to V <sub>OS</sub>	t <sub>PHZ</sub> , t <sub>PLZ</sub>	C <sub>L</sub> = 50pF	0	4.5	-	-	65	-	81	-	98	ns
			-4.5	4.5	-	-	55	-	69	-	83	ns
		C <sub>L</sub> = 15pF	-	5	-	23	-	-	-	-	-	ns
Setup Time 4351 Sn to LE		C <sub>L</sub> = 50pF	0	4.5	-	-	12	-	15	-	18	ns
			-4.5	4.5	-	-	14	-	18	-	21	ns
Hold Time 4351 and 4352 Sn to LE		C <sub>L</sub> = 50pF	0	4.5	5	-	-	5	-	5	-	ns
			-4.5	4.5	5	-	-	5	-	5	-	ns
Pulse Width 4351 LE	t <sub>W</sub>	C <sub>L</sub> = 50pF	0	4.5	25	-	-	31	-	28	-	ns
			-4.5	4.5	25	-	-	31	-	38	-	ns
Input (Control) Capacitance	C <sub>I</sub>	-	-	-	-	-	10	-	10	-	10	pF
Power Dissipation Capacitance (Notes 7, 8) 4351	C <sub>PD</sub>	-	-	5	-	52	-	-	-	-	-	pF

**NOTES:**

7. C<sub>PD</sub> is used to determine the dynamic power consumption, per package.

8.  $P_D = C_{PD} V_{CC}^2 f_i + \sum (C_L + C_S) V_{CC}^2 f_o$  where  $f_i$  = input frequency,  $f_o$  = output frequency,  $C_L$  = output load capacitance,  $C_S$  = switch capacitance,  $V_{CC}$  = supply voltage.

**CD74HC4351, CD74HCT4351, CD74HC4352**

**Analog Channel Specifications**  $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	TEST CONDITIONS	TYPE	$V_{EE}$ (V)	$V_{CC}$ (V)	HC/HCT	UNITS
Switch Input Capacitance	$C_I$		All	-	-	5	pF
Common Capacitance	$C_{COM}$		4351	-	-	25	pF
			4352	-	-	12	pF
Minimum Switch Frequency Response at -3dB (Figure 5, 7)	$f_{MAX}$	See Figure 11 Notes 9, 10	4351	-	-	145	MHz
			4352	-2.25	2.25	165	MHz
			4351	-	-	180	MHz
			4352	-4.5	4.5	185	MHz
Crosstalk Between Any Two Switches (Note 12)		See Figure 10 Notes 10, 11	4351	-	-	N/A	dB
			4352	-2.25	2.25	(TBE)	dB
			4351	-	-	N/A	dB
			4352	-4.5	4.5	(TBE)	dB
Sine-Wave Distortion		See Figure 12	All	-2.25	2.25	0.035	%
			All	-4.5	4.5	0.018	%
$\bar{E}$ or S to Switch Feedthrough Noise		See Figure 13 Notes 10, 11	4351	-	-	-	mV
			4352	-2.25	2.25	(TBE)	mV
			4351	-	-	-	mV
			4352	-4.5	4.5	(TBE)	mV
Switch "OFF" Signal Feedthrough (Figure 6, 8)		See Figure 14 Notes 10, 11	4351	-	-	-73	dB
			4352	-2.25	2.25	-65	dB
			4351	-	-	-75	dB
			4352	-4.5	4.5	-67	dB

**NOTES:**

9. Adjust input voltage to obtain 0dBm at  $V_{OS}$  for,  $f_{in} = 1\text{MHz}$ .
10.  $V_{IS}$  is centered at  $(V_{CC} - V_{EE})/2$ .
11. Adjust input for 0dBm.
12. Not applicable for HC/HCT4351.

Typical Performance Curves

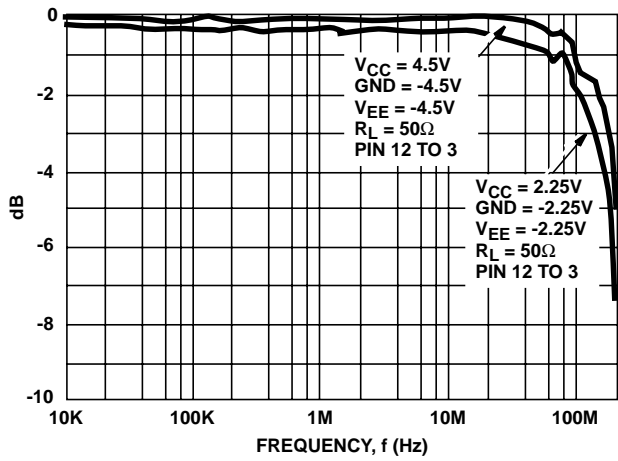


FIGURE 5. CHANNEL ON BANDWIDTH (HC/HCT4351)

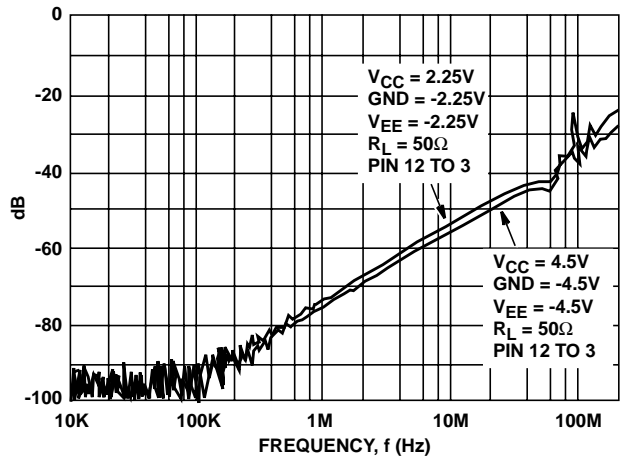


FIGURE 6. CHANNEL OFF FEEDTHROUGH (HC/HCT4351)

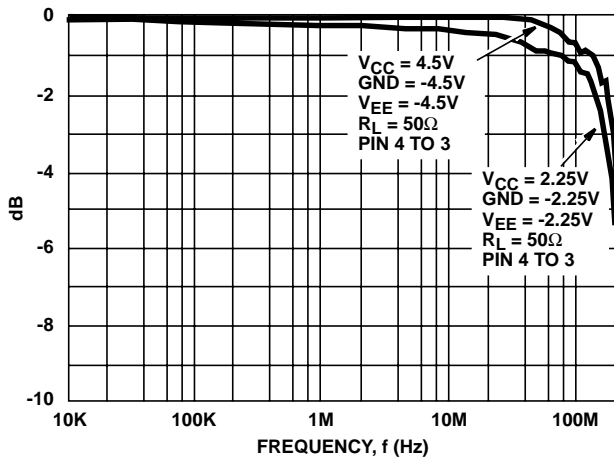


FIGURE 7. CHANNEL ON BANDWIDTH (HC4352)

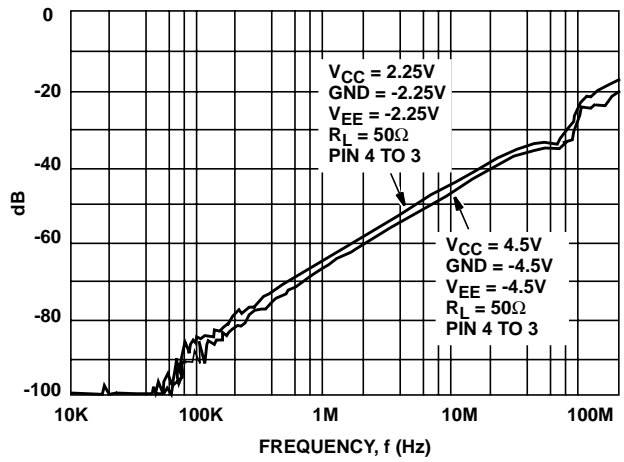


FIGURE 8. CHANNEL OFF FEEDTHROUGH (HC4352)

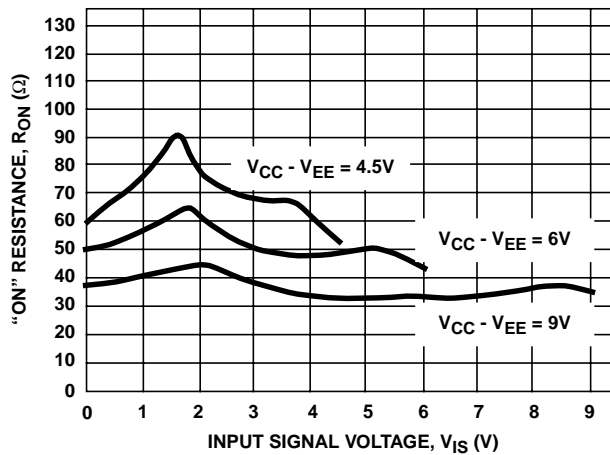


FIGURE 9. TYPICAL ON RESISTANCE vs INPUT SIGNAL VOLTAGE

Analog Test Circuits

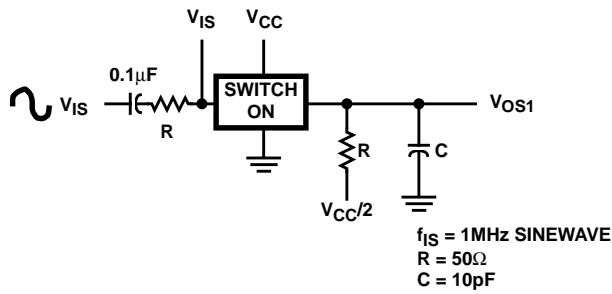


FIGURE 10. CROSTALK BETWEEN TWO SWITCHES TEST CIRCUIT

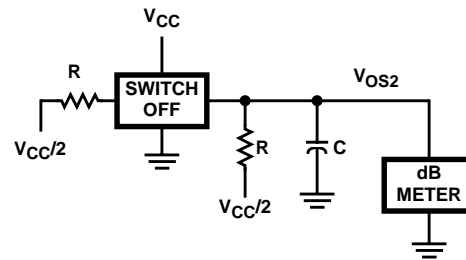


FIGURE 11. FREQUENCY RESPONSE TEST CIRCUIT

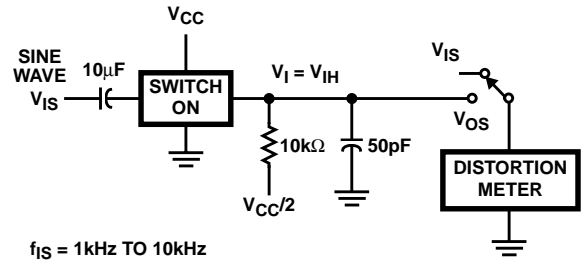


FIGURE 12. TOTAL HARMONIC DISTORTION TEST CIRCUIT

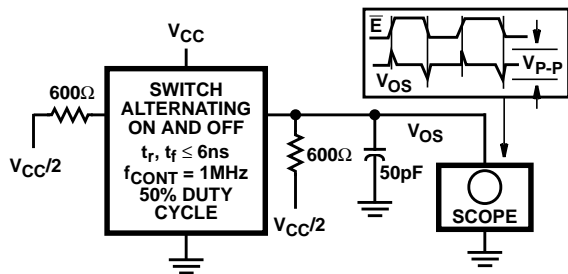


FIGURE 13. CONTROL-TO-SWITCH FEEDTHROUGH NOISE TEST CIRCUIT

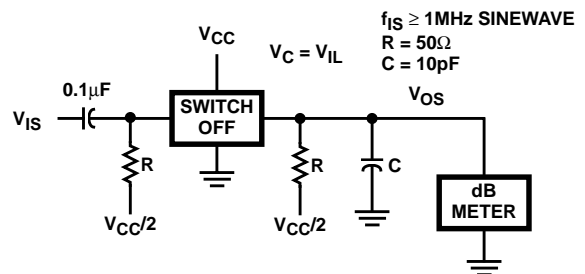
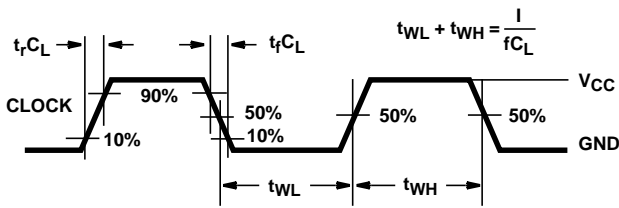


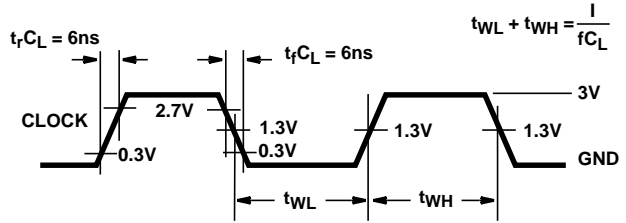
FIGURE 14. SWITCH OFF SIGNAL FEEDTHROUGH TEST CIRCUIT

Test Circuits and Waveforms



NOTE: Outputs should be switching from 10%  $V_{CC}$  to 90%  $V_{CC}$  in accordance with device truth table. For  $f_{MAX}$ , input duty cycle = 50%.

FIGURE 15. HC CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH



NOTE: Outputs should be switching from 10%  $V_{CC}$  to 90%  $V_{CC}$  in accordance with device truth table. For  $f_{MAX}$ , input duty cycle = 50%.

FIGURE 16. HCT CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

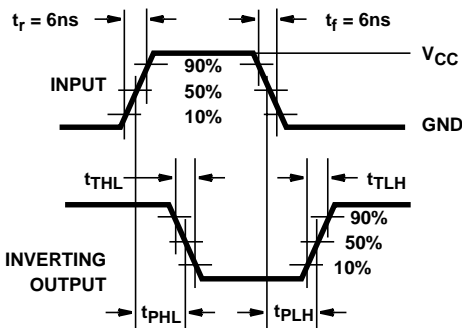


FIGURE 17. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

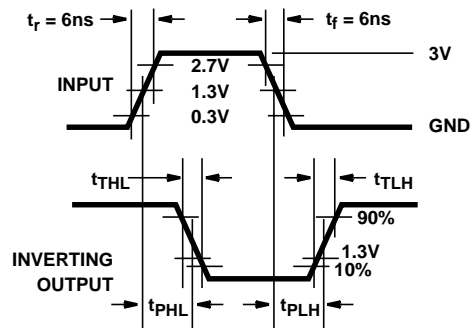


FIGURE 18. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

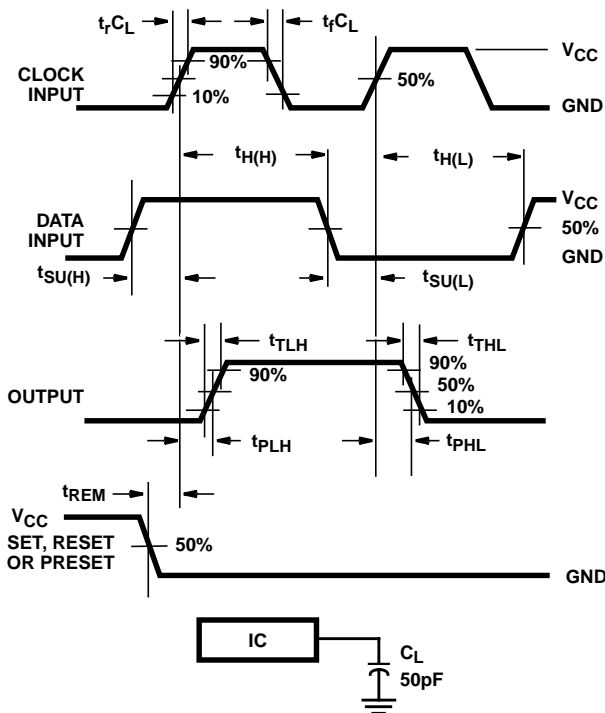


FIGURE 19. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

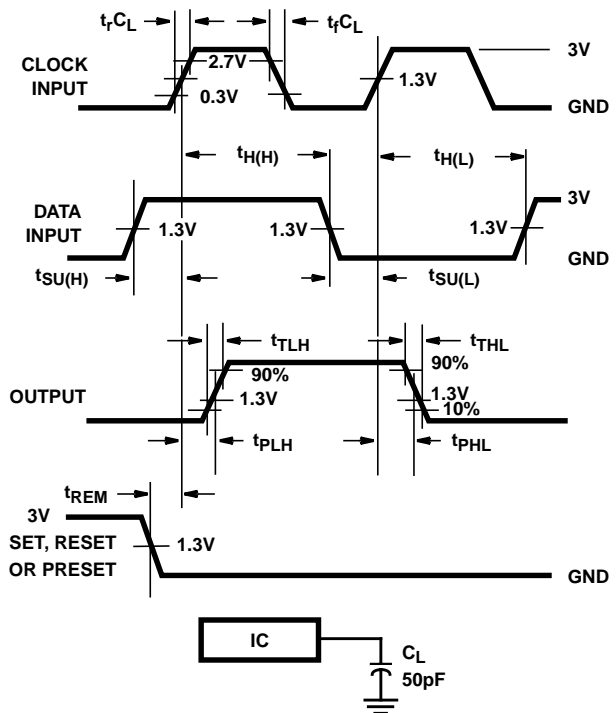


FIGURE 20. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

**Test Circuits and Waveforms** (Continued)

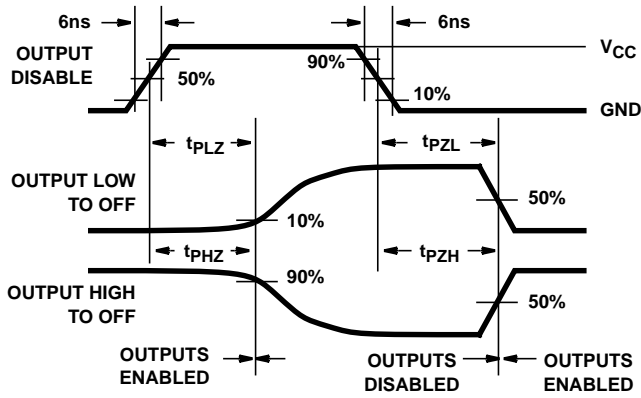


FIGURE 21. HC THREE-STATE PROPAGATION DELAY WAVEFORM

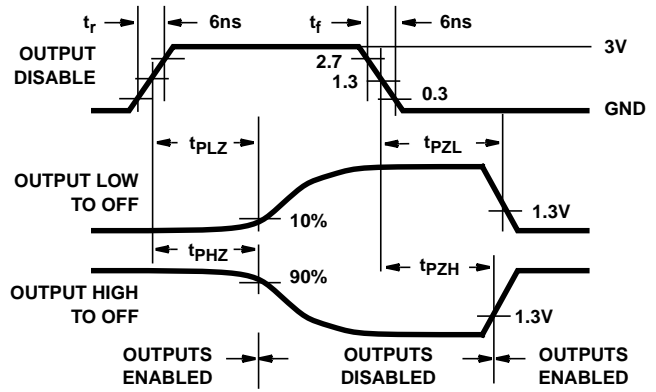
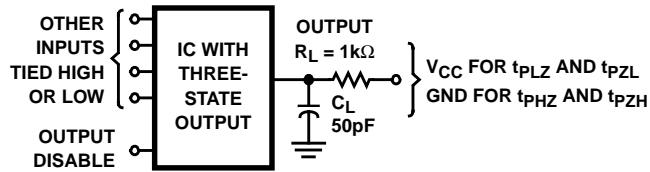


FIGURE 22. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



NOTE: Open drain waveforms  $t_{PLZ}$  and  $t_{PZL}$  are the same as those for three-state shown on the left. The test circuit is Output  $R_L = 1k\Omega$  to  $V_{CC}$ ,  $C_L = 50pF$ .

FIGURE 23. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.