

To all our customers

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Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

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# HD74HC4052/HD74HC4053

Dual 4-channel Analog Multiplexers/Demultiplexers  
Triple 2-channel Analog Multiplexers/Demultiplexers



ADE-205-536 (Z)

1st. Edition

Sep. 2000

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## Description

**HD74HC4052:** This device connects together the outputs of 4 switches in two sets, thus achieving a pair of 4 channel multiplexers. The binary code placed on the A, and B select lines determine which switch in each 4 channel section is “on”, connecting one of the four inputs in each section to its common output. This enables the implementation of a 4 channel differential multiplexer.

**HD74HC4053:** This device contains 6 switches whose outputs are connected together in pairs, thus implementing a triple 2 channel multiplexer, or the equivalent of 3 single-pole-double throw configuration. Each of the A, B, or C select lines independently controls one pair of switches, selecting one of the two switches to be “on”.

## Features

- High Speed Operation
- Wide Operating Voltage
- Low Quiescent Supply Current

# HD74HC4052/HD74HC4053

## Function Table

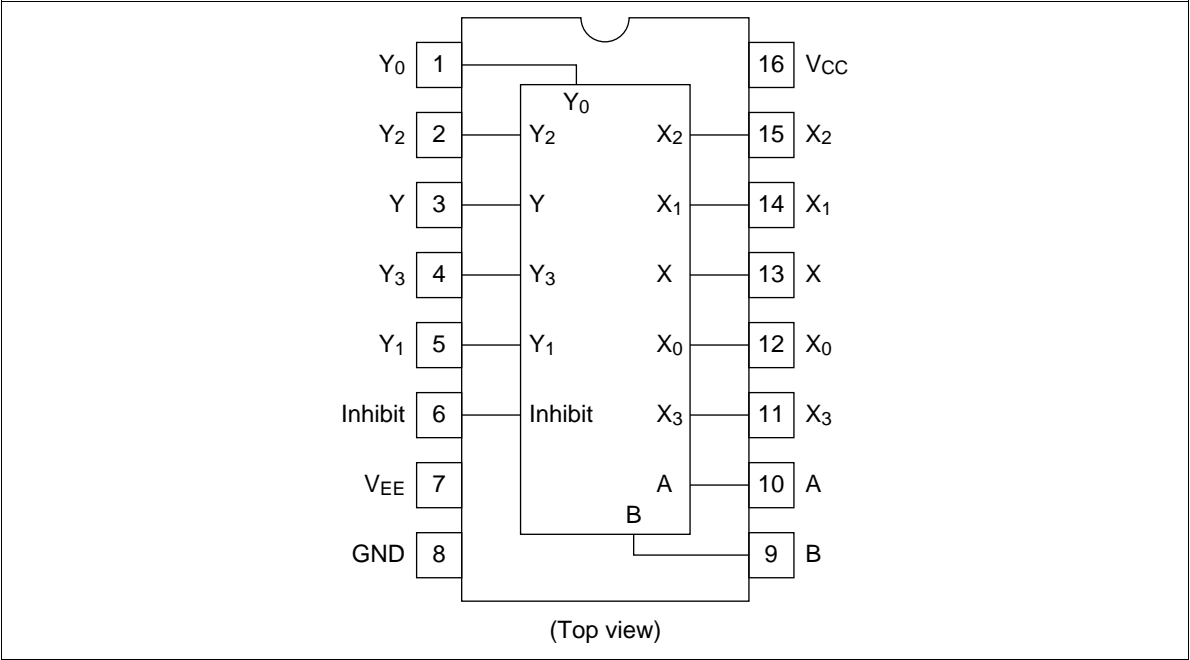
### Control Inputs

Inhibit	Select			ON Switch				
	C* <sup>1</sup>	B	A	HD74HC4052		HD74HC4053		
L	L	L	L	Y <sub>0</sub>	X <sub>0</sub>	Z <sub>0</sub>	Y <sub>0</sub>	X <sub>0</sub>
L	L	L	H	Y <sub>1</sub>	X <sub>1</sub>	Z <sub>0</sub>	Y <sub>0</sub>	X <sub>1</sub>
L	L	H	L	Y <sub>2</sub>	X <sub>2</sub>	Z <sub>0</sub>	Y <sub>1</sub>	X <sub>0</sub>
L	L	H	H	Y <sub>3</sub>	X <sub>3</sub>	Z <sub>0</sub>	Y <sub>1</sub>	X <sub>1</sub>
L	H	L	L			Z <sub>1</sub>	Y <sub>0</sub>	X <sub>0</sub>
L	H	L	H			Z <sub>1</sub>	Y <sub>0</sub>	X <sub>1</sub>
L	H	H	L			Z <sub>1</sub>	Y <sub>1</sub>	X <sub>0</sub>
L	H	H	H			Z <sub>1</sub>	Y <sub>1</sub>	X <sub>1</sub>
H	X	X	X	—		—		

Note: 1. Not applicable for HD74HC4052  
X = Don't Care

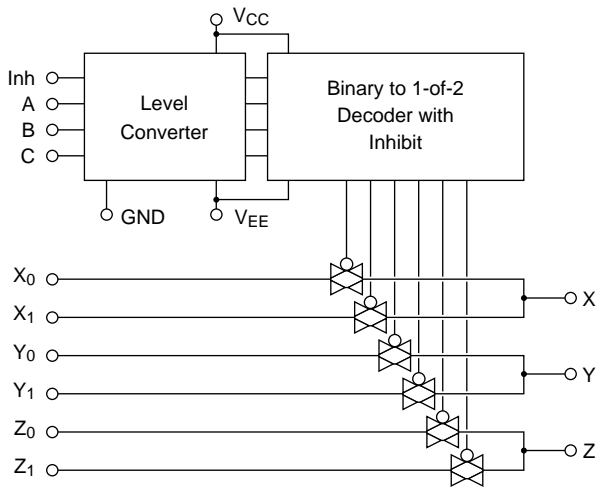
## Pin Arrangement

### HD74HC4052





HD74HC4053



Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to +7.0	V
	$V_{CC} - V_{EE}$	-0.5 to +7.0	V
Control input voltage	$V_{IN}$	GND - 0.5 to $V_{CC} + 0.5$	V
Switch I/O voltage	$V_{I/O}$	$V_{EE} - 0.5$ to $V_{CC} + 0.5$	V
Supply current	( $V_{CC}$ ) $I_{CC}$	+50	mA
	(GND) $I_{GND}$	-50	mA
Switch I/O current (per pin)	$I_{I/O}$	±25	mA
Control input diode current	$I_{IK}$	±20	mA
Switch I/O diode current	$I_{IOK}$	±20	mA
Power dissipation	$P_T$	500	mW
Storage temperature range	Tstg	-65 to +150	°C

## Recommended Operating Range

Item		Symbol	Min	Typ	Max	Unit
Supply voltage		$V_{CC} - V_{EE}$	2	—	6	V
		$GND - V_{EE}$	−4	—	0	V
Control input voltage		$V_{IN}$	0	—	$V_{CC}$	V
Switch I/O voltage		$V_{I/O}$	$V_{EE}$	—	$V_{CC}$	V
Operating temperature		Topr	−40	—	+85	°C
Input rise/fall time	$V_{CC} = 2.0\text{ V}$	$t_r, t_f$	0	—	1000	ns
	$V_{CC} = 4.5\text{ V}$		0	—	500	ns
	$V_{CC} = 6.0\text{ V}$		0	—	400	ns

## DC Characteristics ( $V_{EE} = \text{GND}$ )

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = −40 to +85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Control input voltage	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V	
		4.5	3.15	—	—	3.15	—		
		6.0	4.2	—	—	4.2	—		
	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5	V	
		4.5	—	—	1.35	—	1.35		
		6.0	—	—	1.8	—	1.8		
ON resistance	R <sub>ON</sub>	2.0	—	2000	5000	—	6250	Ω	V <sub>INH</sub> = V <sub>IL</sub>
		4.5	—	120	180	—	225		V <sub>I/O</sub> = V <sub>CC</sub> to V <sub>EE</sub>
		6.0	—	100	170	—	210		I <sub>I/O</sub> ≤ 2 mA
		2.0	—	200	800	—	1000	Ω	V <sub>INH</sub> = V <sub>IL</sub>
		4.5	—	80	150	—	190		V <sub>I/O</sub> = V <sub>CC</sub> to V <sub>EE</sub>
		6.0	—	70	140	—	175		V <sub>I/O</sub> ≤ 2 mA
ΔON resistance between any two channels	ΔR <sub>ON</sub>	2.0	—	50	—	—	—	Ω	V <sub>INH</sub> = V <sub>IL</sub>
		4.5	—	13	40	—	50		V <sub>I/O</sub> = V <sub>CC</sub> to V <sub>EE</sub>
		6.0	—	10	20	—	25		I <sub>I/O</sub> ≤ 2 mA
OFF channel leakage current (switch off)	I <sub>S (OFF)</sub>	6.0	—	—	±0.1	—	±1.0	μA	V <sub>INH</sub> = V <sub>IL</sub>
OFF channel leakage current (switch on)	I <sub>S (ON)</sub>	6.0	—	—	±0.1	—	±1.0	μA	V <sub>INH</sub> = V <sub>IL</sub>
Control input current	I <sub>in</sub>	6.0	—	—	±0.1	—	±1.0	μA	V <sub>in</sub> = V <sub>CC</sub> or GND
Quiescent supply current	I <sub>CC</sub>	6.0	—	—	4.0	—	40	μA	V <sub>in</sub> = V <sub>CC</sub> or GND



**AC Characteristics** ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ ,  $V_{EE} = \text{GND}$ )

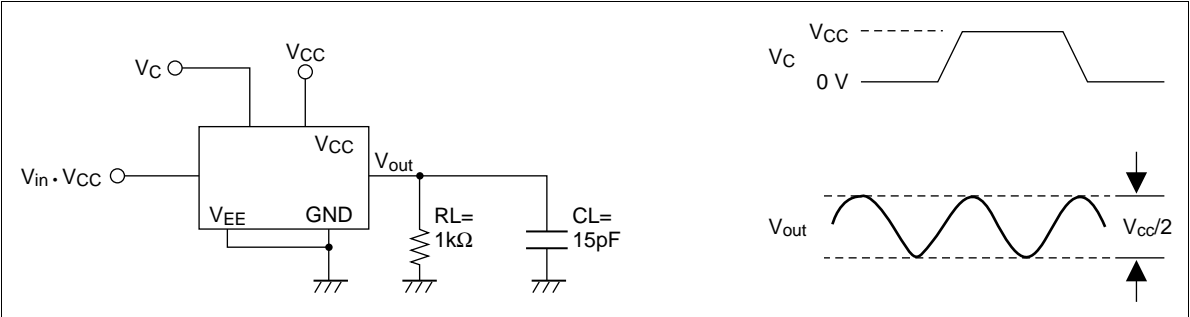
Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = −40 to +85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	t <sub>PLH</sub>	2.0	—	25	60	—	75	ns	R <sub>L</sub> = 10 kΩ
		4.5	—	6	12	—	15		Switch input to switch output
		6.0	—	5	10	—	13		
	t <sub>PHL</sub>	2.0	—	25	60	—	75	ns	
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
Propagation delay time	t <sub>PLH</sub>	2.0	—	50	153	—	191	ns	R <sub>L</sub> = 10 kΩ
		4.5	—	16	30	—	38		Control input to switch output
		6.0	—	14	26	—	33		
	t <sub>PHL</sub>	2.0	—	50	153	—	191	ns	
		4.5	—	16	30	—	38		
		6.0	—	14	26	—	33		
Output enable time	t <sub>ZH</sub>	2.0	—	50	153	—	191	ns	R <sub>L</sub> = 1 kΩ
		4.5	—	14	30	—	38		
		6.0	—	12	26	—	33		
	t <sub>ZL</sub>	2.0	—	50	153	—	191	ns	
		4.5	—	14	30	—	38		
		6.0	—	12	26	—	33		
Output disable time	t <sub>HZ</sub>	2.0	—	40	153	—	191	ns	R <sub>L</sub> = 1 kΩ
		4.5	—	17	30	—	38		
		6.0	—	14	26	—	33		
	t <sub>LZ</sub>	2.0	—	40	153	—	191	ns	
		4.5	—	17	30	—	38		
		6.0	—	14	26	—	33		
Control input capacitance	C <sub>in</sub>	—	—	5	10	—	10	pF	
Switch input capacitance	C <sub>in</sub>	5.0	—	5	—	—	—	pF	
Output capacitance (Common pin)	C <sub>out</sub>	5.0	—	12	—	—	—	pF	HD74HC4052
		5.0	—	6	—	—	—		HD74HC4053
Feed through capacitance	C <sub>in</sub> –out	5.0	—	0.6	—	—	—	pF	HD74HC4052
		5.0	—	0.5	—	—	—		HD74HC4053

AC Characteristics (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns, V<sub>EE</sub> = GND) (cont)

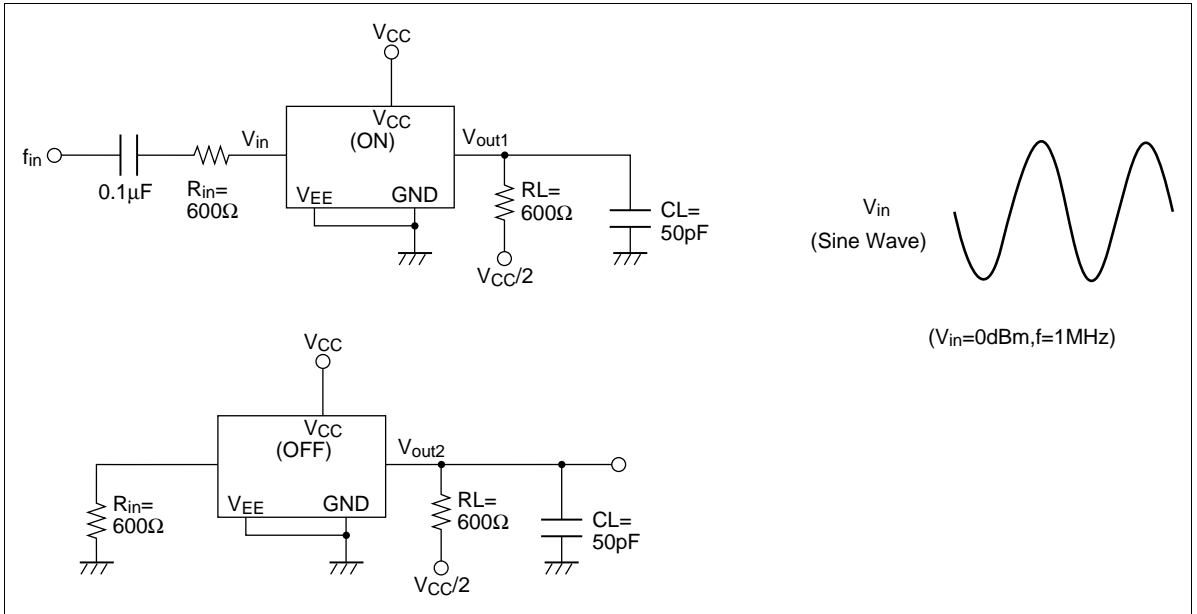
Item	Symbol	V <sub>cc</sub> (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Power dissipation	C <sub>PD</sub>	5.0	—	32.0	—	—	—	pF	HD74HC4052
capacitance		5.0	—	17.0	—	—	—		HD74HC4053
Sine wave distortion		4.5	—	0.1	—	—	—	%	f <sub>in</sub> = 1 kHz, Vin = 4 V <sub>P-P</sub> R <sub>L</sub> = 10 kΩ, C <sub>L</sub> = 50 pF
Frequency response channel "ON" (Sine wave input)		4.5	—	95	—	—	—	MHz	f <sub>in</sub> = 1 MHz, 20 log <sub>10</sub> V <sub>OS</sub> /V <sub>IS</sub> = -3 dB R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 10 pF
Feed through attenuation		4.5	—	-50	—	—	—	dB	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF, f <sub>in</sub> = 1 MHz
Cross talk between control input and switch I/O		2.0	—	25	—	—	—	mV	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 15 pF, f <sub>in</sub> = 1 MHz
		4.5	—	50	—	—	—		
		6.0	—	75	—	—	—		
Cross talk between any two switches		4.5	—	-50	—	—	—	dB	R <sub>L</sub> = 600 Ω, C <sub>L</sub> = 50 pF, f <sub>in</sub> = 1 MHz
Maximum control frequency		2.0	—	20	—	—	—	MHz	R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 15 pF V <sub>out</sub> = 1/2 (V <sub>cc</sub> )
		4.5	—	30	—	—	—		
		6.0	—	30	—	—	—		

AC Characteristics Test Circuit

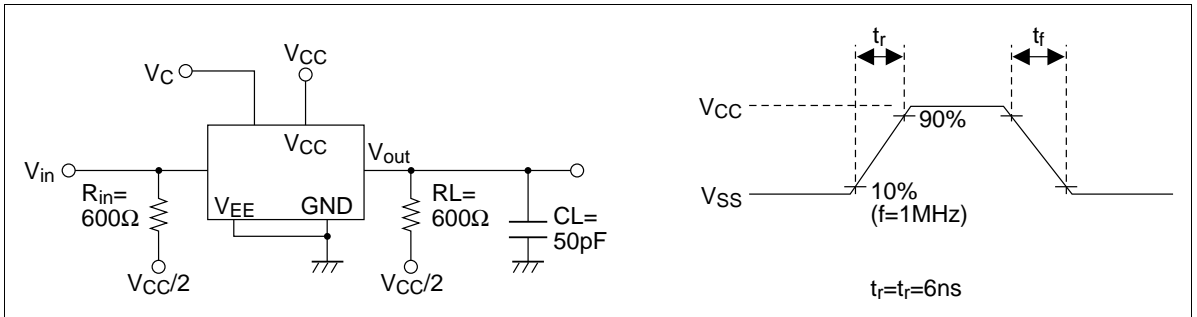
Maximum Control Frequency



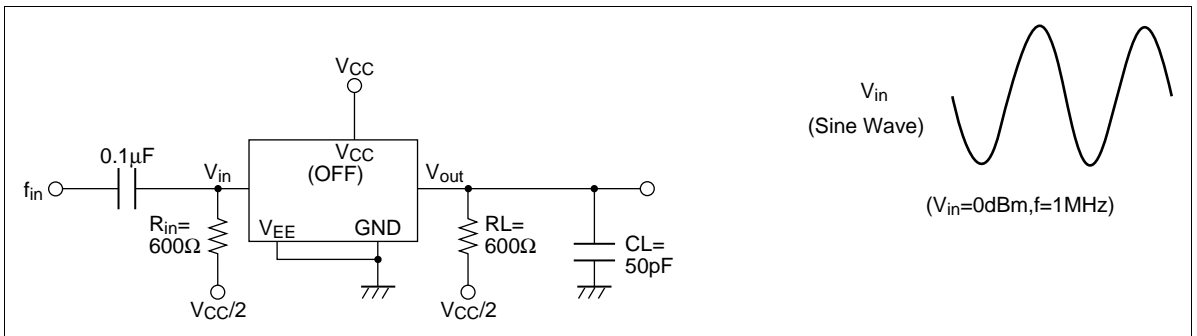
## Cross talk (Between Any Two Switches)



## Cross talk (Control Input to Switch Output)

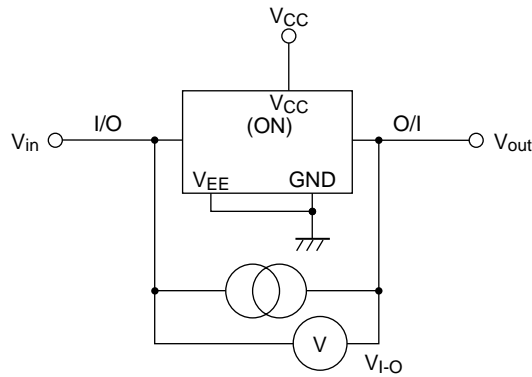


## Feed through Attenuation

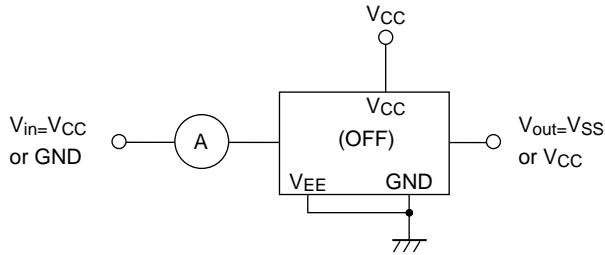




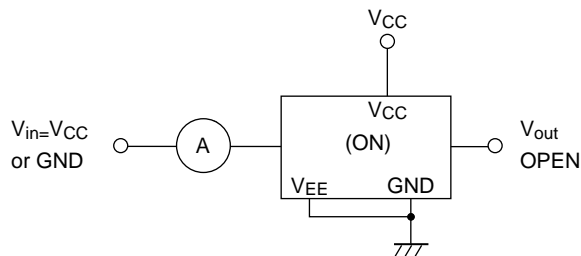
**$R_{ON}$ : ON Resistance**



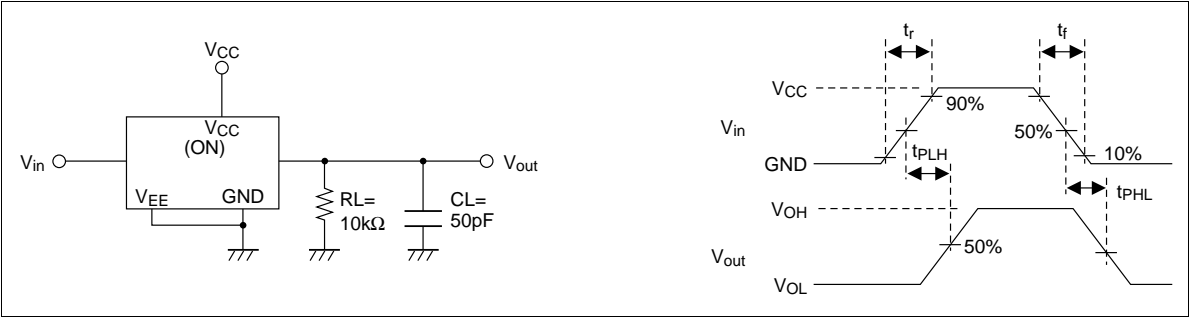
**$I_s$  (OFF): OFF Channel Leakage Current (Switch OFF)**



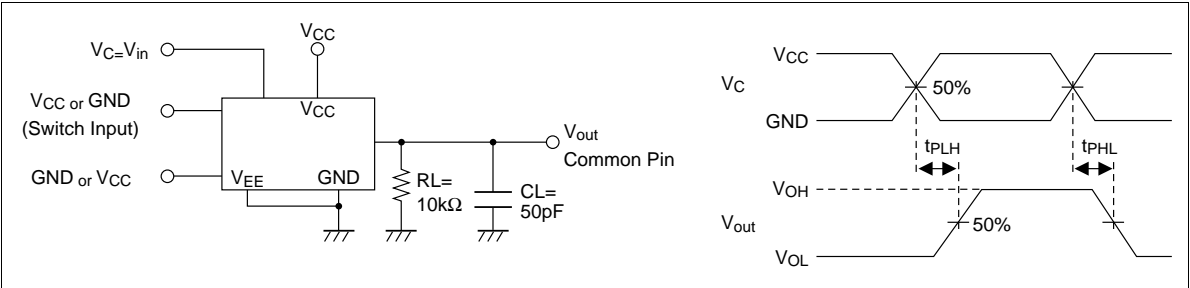
**$I_s$  (ON): OFF Channel Leakage Current (Switch ON)**



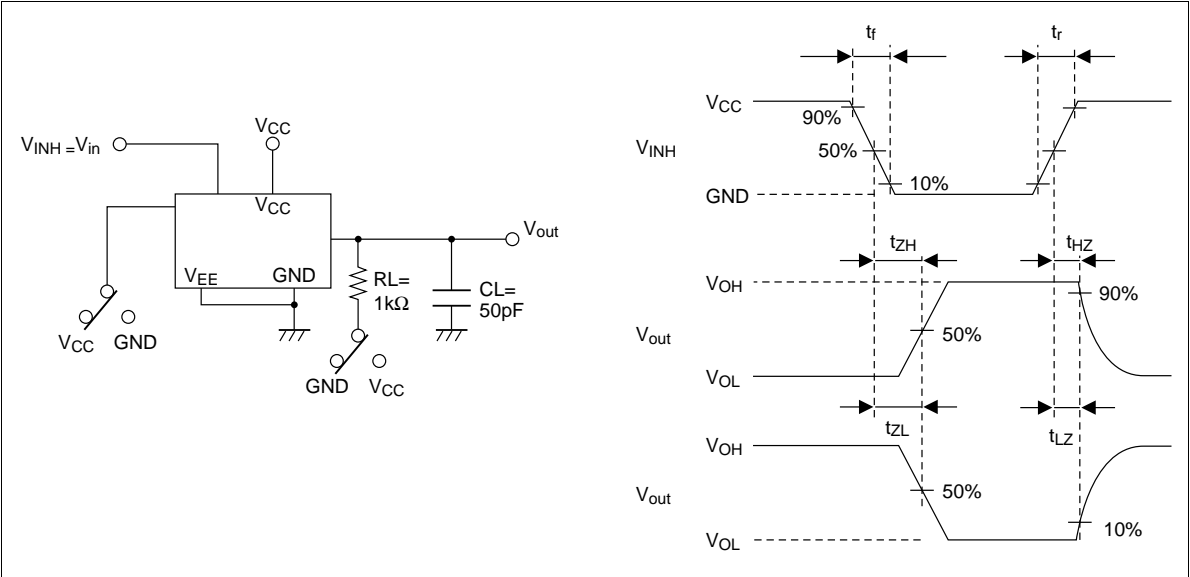
**$t_{PLH}$ ,  $t_{PHL}$ : Propagation Delay Time (Switch Input to Switch Output)**



**$t_{PLH}$ ,  $t_{PHL}$ : Propagation Delay Time (Control Input to Switch Output)**

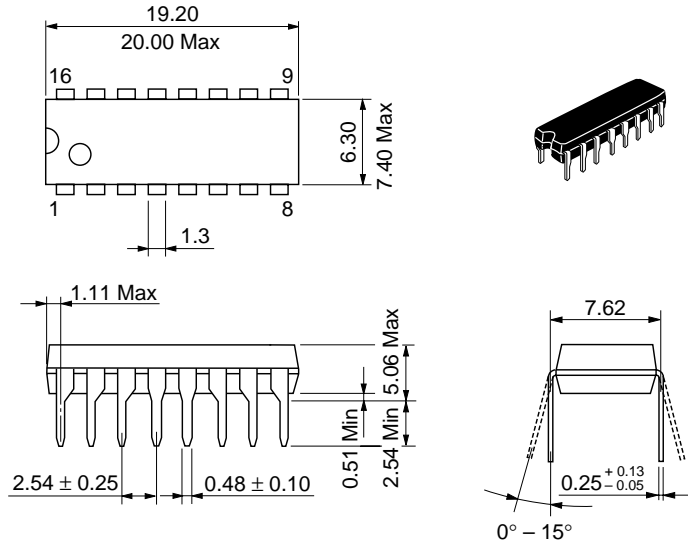


**$t_{ZH}$ ,  $t_{ZL}/t_{HZ}$ ,  $t_{LZ}$ : Output Enable and Disable Time**



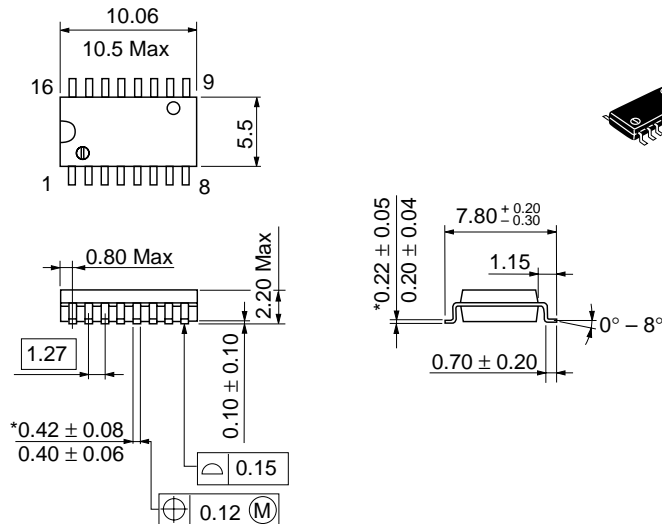
# Package Dimensions

Unit: mm



Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	1.07 g

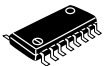
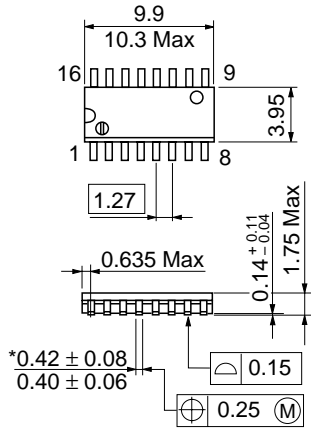
Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.24 g

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.15 g



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