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# HD74HC4051

## 8-Channel Analog Multiplexer Demultiplexer

# HITACHI

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### Description

This device connects together the outputs of 8 switches, thus achieving an 8 Channel Multiplexer. The binary code placed on the A, B, and C select lines determine which one of the eight switches in “on”, and connects one of the eight inputs to the common output.

### Features

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

### Function Table

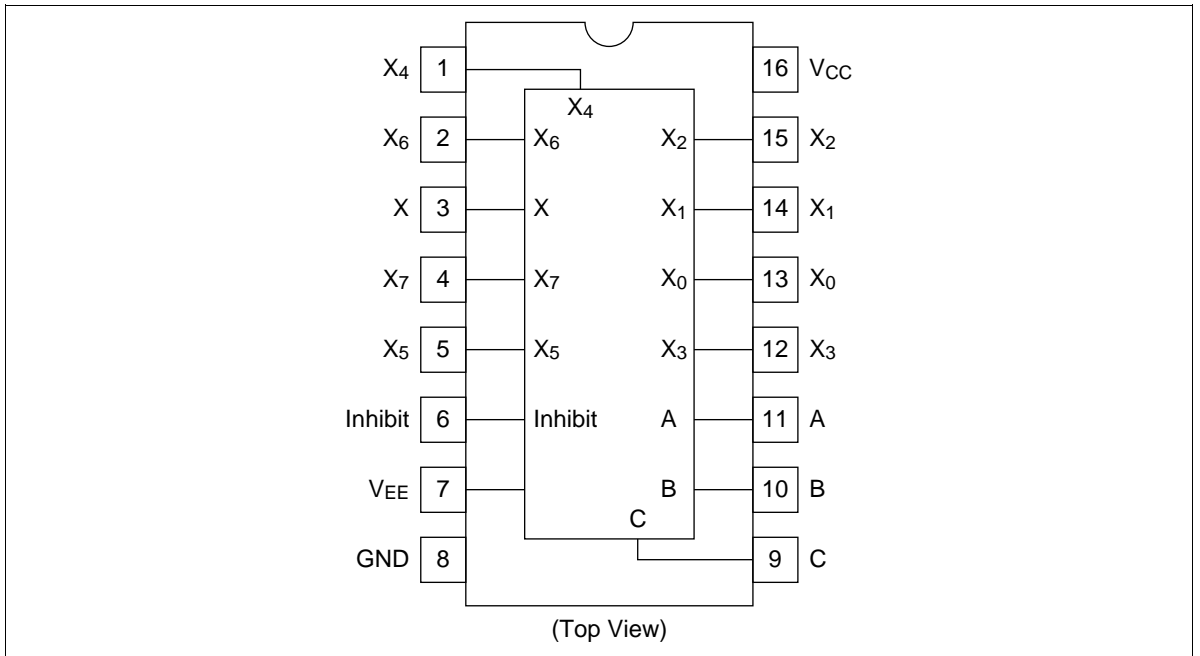
#### Control Inputs

Inhibit	C	B	A	ON Switch
L	L	L	L	X <sub>0</sub>
L	L	L	H	X <sub>1</sub>
L	L	H	L	X <sub>2</sub>
L	L	H	H	X <sub>3</sub>
L	H	L	L	X <sub>4</sub>
L	H	L	H	X <sub>5</sub>
L	H	H	L	X <sub>6</sub>
L	H	H	H	X <sub>7</sub>
H	X	X	X	—

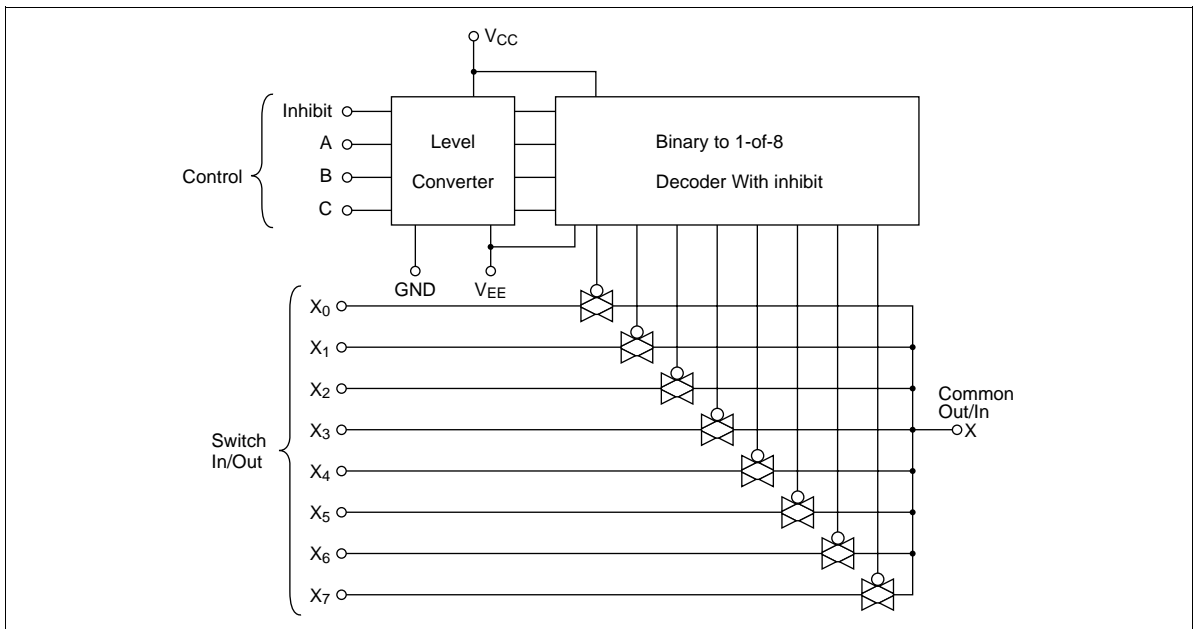
X : Don't Care

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## Pin Arrangement



## Block Diagram



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**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)	$I_{I/O}$	$\pm 25$	mA
Control input diode current	$I_{IK}$	$\pm 20$	mA
Switch I/O diode current	$I_{IOK}$	$\pm 20$	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	
	$V_{GND} - V_{EE}$	-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	$V_{CC} = 2.0$ V	$t_r, t_f$	0	—	1000	ns
	$V_{CC} = 4.5$ V		0	—	500	ns
	$V_{CC} = 6.0$ V		0	—	400	ns

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

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40$ to $+85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Control input voltage	$V_{IH}$	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	$V_{IL}$	2.0	—	—	0.5	—	0.5			V
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
ON resistance	$R_{ON}$	2.0	—	2000	5000	—	6250	$\Omega$	$V_{INH} = V_{IL}$	
		4.5	—	120	180	—	225		$V_{IO} = V_{CC}$ to $V_{EE}$	
		6.0	—	100	170	—	210		$I_{IO} \leq 2 \text{ mA}$	
		$R_{ON}$	2.0	—	200	800	—	1000	$\Omega$	$V_{INH} = V_{IL}$
			4.5	—	80	150	—	190		$V_{IO} = V_{CC}$ to $V_{EE}$
			6.0	—	70	140	—	175		$V_{IO} \leq 2 \text{ mA}$
$\Delta$ ON resistance between any two channels	$\Delta R_{ON}$	2.0	—	50	—	—	—	$\Omega$	$V_{INH} = V_{IL}$	
		4.5	—	13	40	—	50		$V_{IO} = V_{CC}$ to $V_{EE}$	
		6.0	—	10	20	—	25		$I_{IO} \leq 2 \text{ mA}$	
OFF channel leakage current (switch off)	$I_{S(OFF)}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_{INH} = V_{IL}$	
OFF channel leakage current (switch on)	$I_{S(ON)}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_{INH} = V_{IL}$	
Control input current	$I_{in}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_{in} = V_{CC}$ or $V_{SS}$	
Quiescent supply current	$I_{CC}$	6.0	—	—	4.0	—	40	$\mu\text{A}$	$V_{in} = V_{CC}$ or $V_{SS}$	

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

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40$ to $+85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	$t_{PLH}$	2.0	—	25	60	—	75	ns	$R_L = 10$ k $\Omega$
		4.5	—	6	12	—	15		Switch input to
		6.0	—	5	10	—	13		switch output
	$t_{PHL}$	2.0	—	25	60	—	75	ns	
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
Propagation delay time	$t_{PLH}$	2.0	—	50	153	—	191	ns	$R_L = 10$ k $\Omega$
		4.5	—	16	30	—	38		Control input to
		6.0	—	14	26	—	33		switch output
	$t_{PHL}$	2.0	—	50	153	—	191	ns	
		4.5	—	16	30	—	38		
		6.0	—	14	26	—	33		
Output enable time	$t_{ZH}$	2.0	—	50	153	—	191	ns	$R_L = 1$ k $\Omega$
		4.5	—	14	30	—	38		
		6.0	—	12	26	—	33		
	$t_{ZL}$	2.0	—	50	153	—	191	ns	
		4.5	—	14	30	—	38		
		6.0	—	12	26	—	33		
Output disable time	$t_{HZ}$	2.0	—	40	153	—	191	ns	$R_L = 1$ k $\Omega$
		4.5	—	17	30	—	38		
		6.0	—	14	26	—	33		
	$t_{LZ}$	2.0	—	40	153	—	191	ns	
		4.5	—	17	30	—	38		
		6.0	—	14	26	—	33		
Control input capacitance	$C_{in}$	—	—	5	10	—	10	pF	
Switch input capacitance	$C_{in}$	5.0	—	5	—	—	—	pF	
Output capacitance (Common pin)	$C_{out}$	5.0	—	22	—	—	—	pF	
Feed through capacitance	$C_{in-out}$	5.0	—	0.7	—	—	—	pF	
Power dissipation capacitance	$C_{PD}$	5.0	—	22.0	—	—	—	pF	

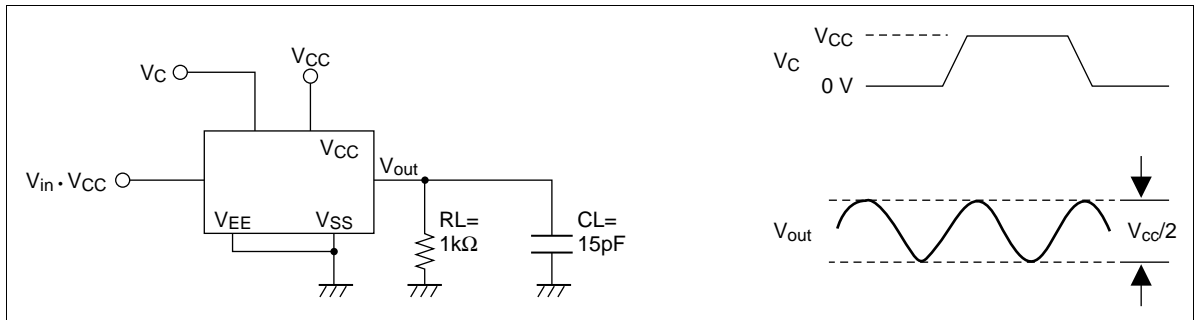
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## AC Characteristics ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 6 \text{ ns}$ , $V_{SS} = V_{EE} = \text{GND}$ ) (cont)

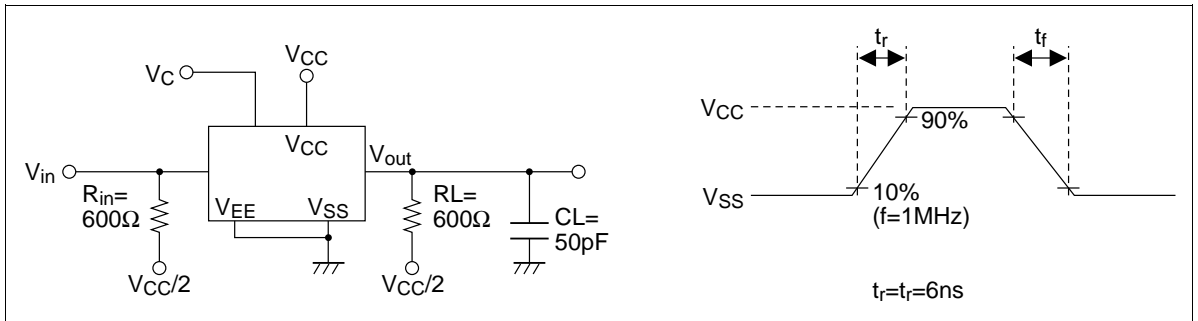
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Sine wave distortion		4.5	—	0.1	—	—	—	%	$f_{in} = 1 \text{ kHz}$ , $V_{in} = 4 V_{P-P}$ $R_L = 10 \text{ k}\Omega$ , $C_L = 50 \text{ pF}$
Frequency response channel "ON" (Sine wave input)		4.5	—	95	—	—	—	MHz	$f_{in} = 1 \text{ MHz}$ , $20 \log_{10} V_{OS}/V_{IS} = -3 \text{ dB}$ $R_L = 50 \Omega$ , $C_L = 10 \text{ pF}$
Feed through attenuation		4.5	—	-50	—	—	—	dB	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ , $f_{in} = 1 \text{ MHz}$
Cross talk between any two switches		2.0	—	25	—	—	—	mV	$R_L = 600 \Omega$ , $C_L = 15 \text{ pF}$ , $f_{in} = 1 \text{ MHz}$
		4.5	—	60	—	—	—		
		6.0	—	75	—	—	—		
Maximum control frequency		2.0	—	20	—	—	—	MHz	$R_L = 1 \text{ k}\Omega$ , $C_L = 15 \text{ pF}$ $V_{out} = 1/2 (V_{CC})$
		4.5	—	30	—	—	—		
		6.0	—	30	—	—	—		

## AC Characteristics Test Circuit

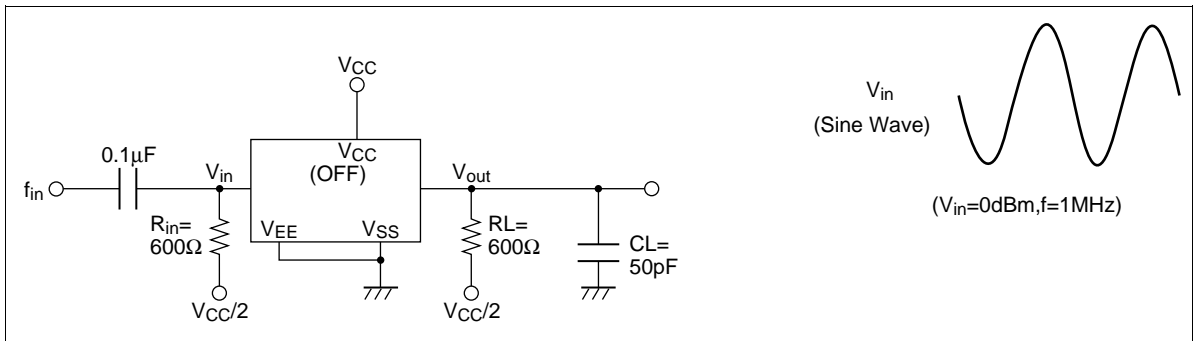
### Maximum Control Frequency



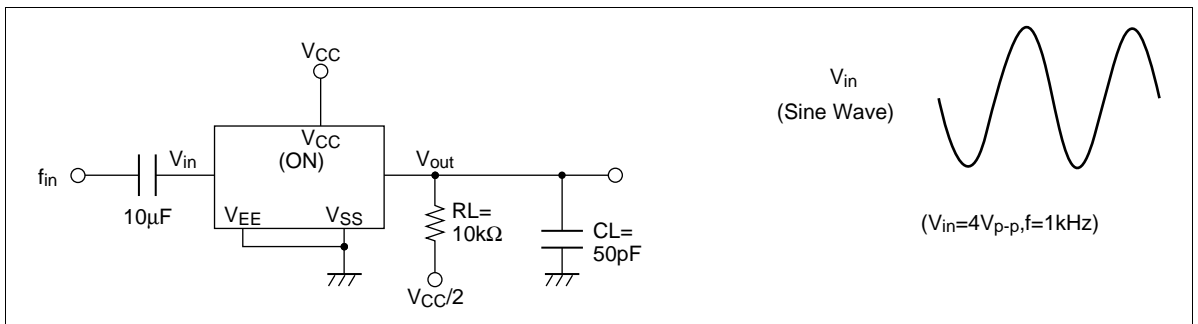
**Cross talk (Control Input to Switch Output)**



**Feed through Attenuation**

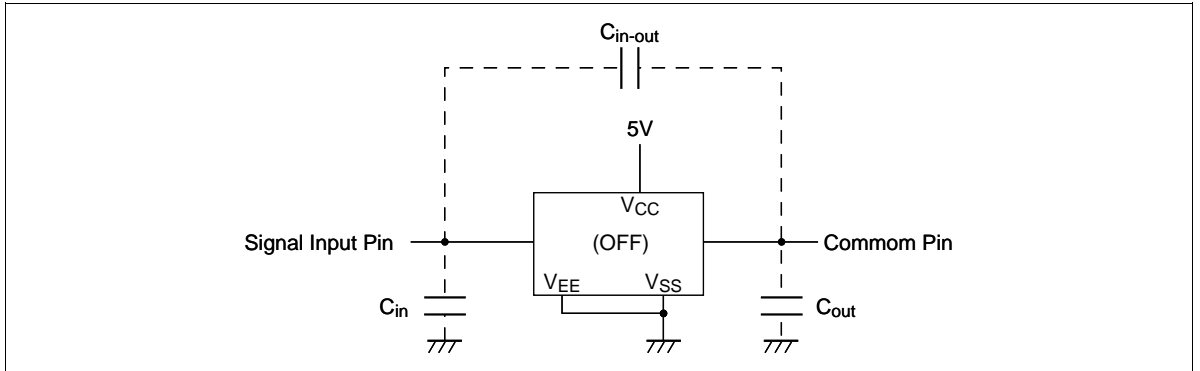


**Sine Wave Distortion**

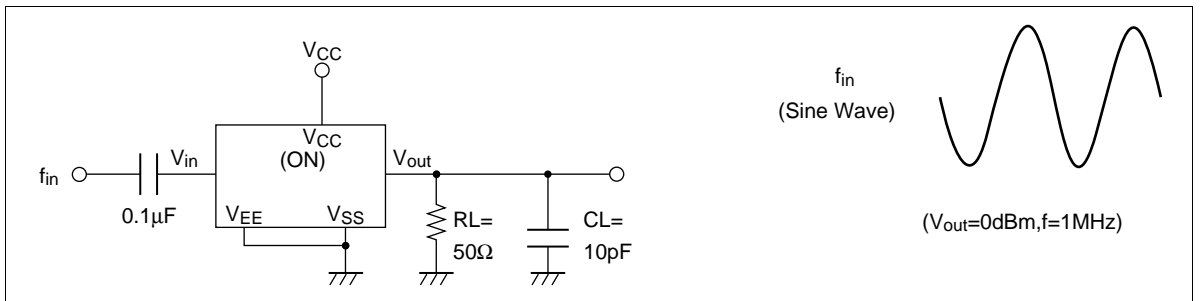


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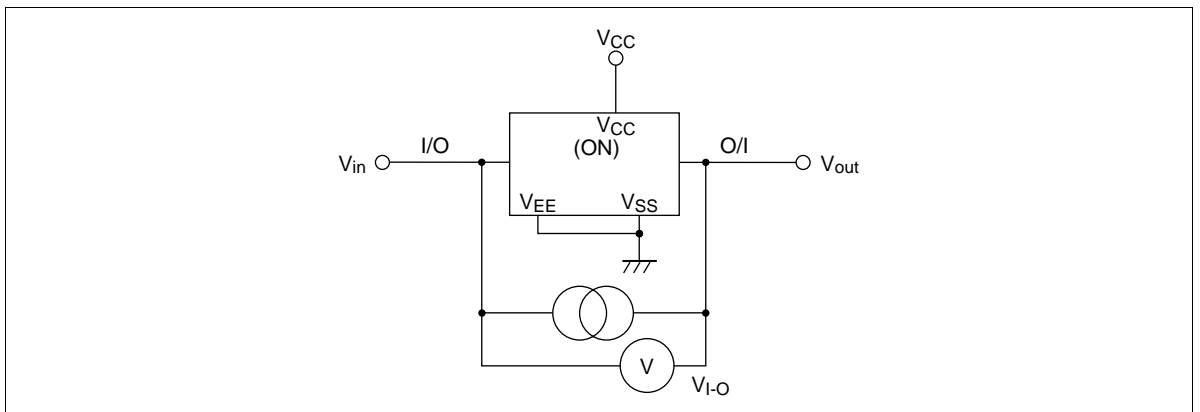
**C<sub>in</sub>, C<sub>out</sub>, C<sub>in-out</sub>** (Input, Output, and Feed through Capacitance)



**Frequency Response Channel ON**

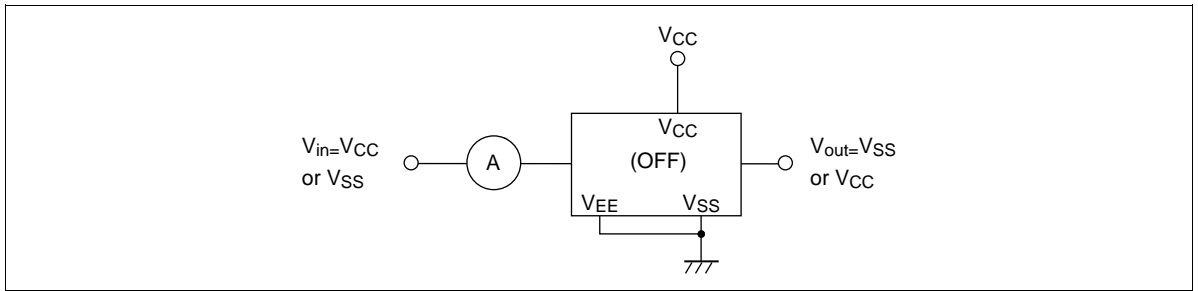


**R<sub>ON</sub>: ON Resistance**

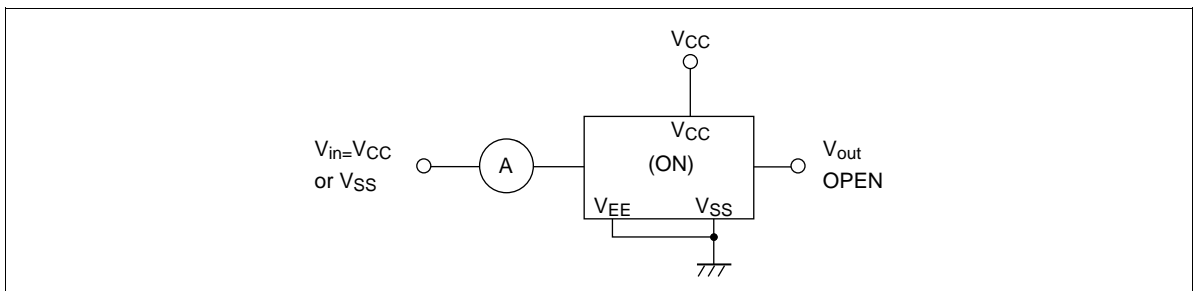




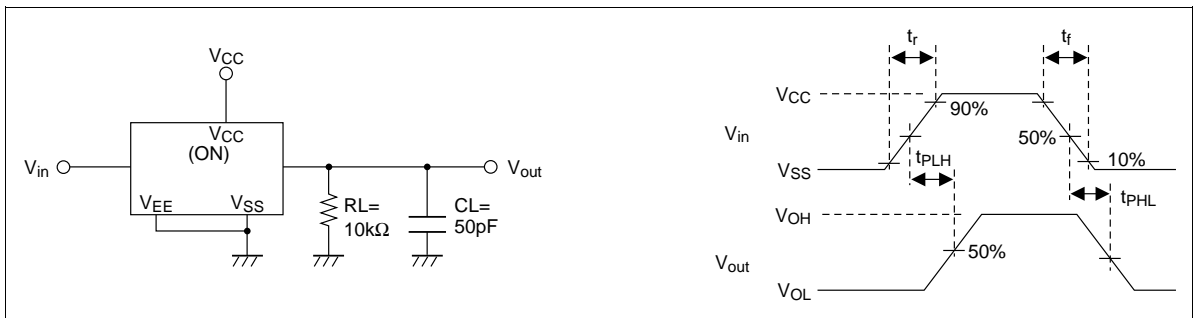
**$I_s$  (OFF): OFF Channel Leakage Current (Switch OFF)**



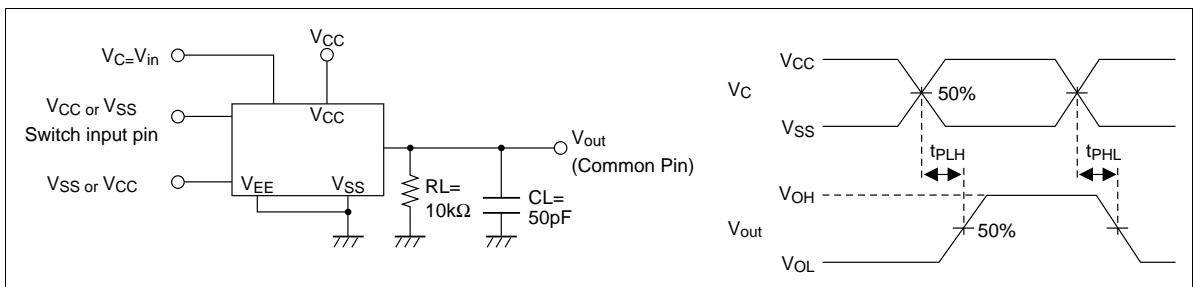
**$I_s$  (ON): OFF Channel Leakage Current (Switch ON)**



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

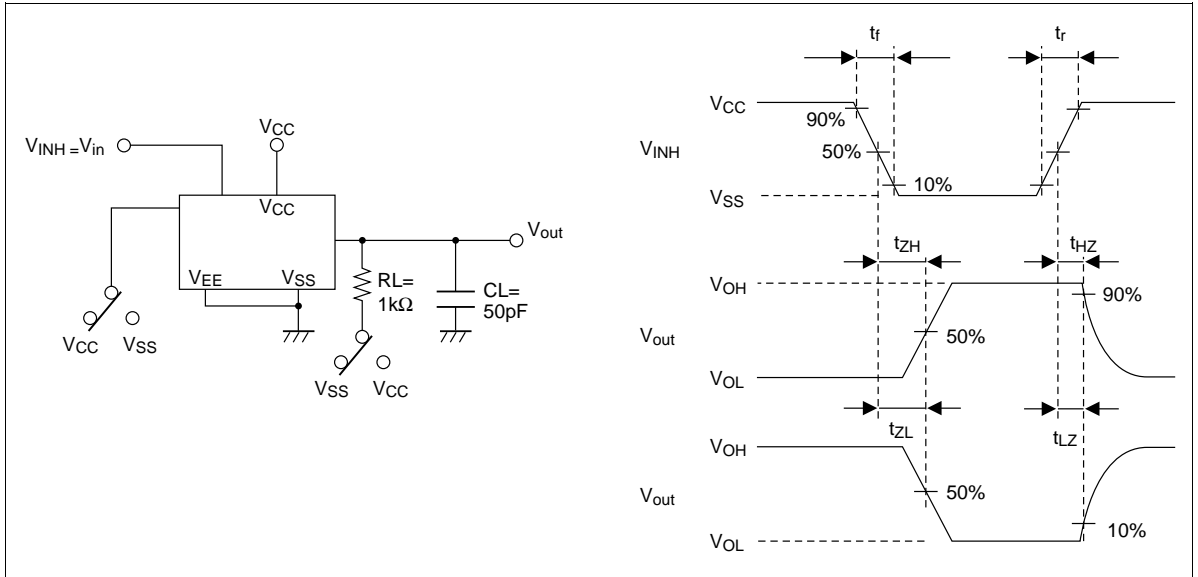


**$t_{PLH}$ ,  $t_{PHL}$ : Propagation Delay Time (Control Input to Switch Output)**



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





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



\*Dimension including the plating thickness  
Base material dimension

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



\*Dimension including the plating thickness  
Base material dimension

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

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