
HD74HC4051

8-Channel Analog Multiplexer Demultiplexer

HITACHI

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

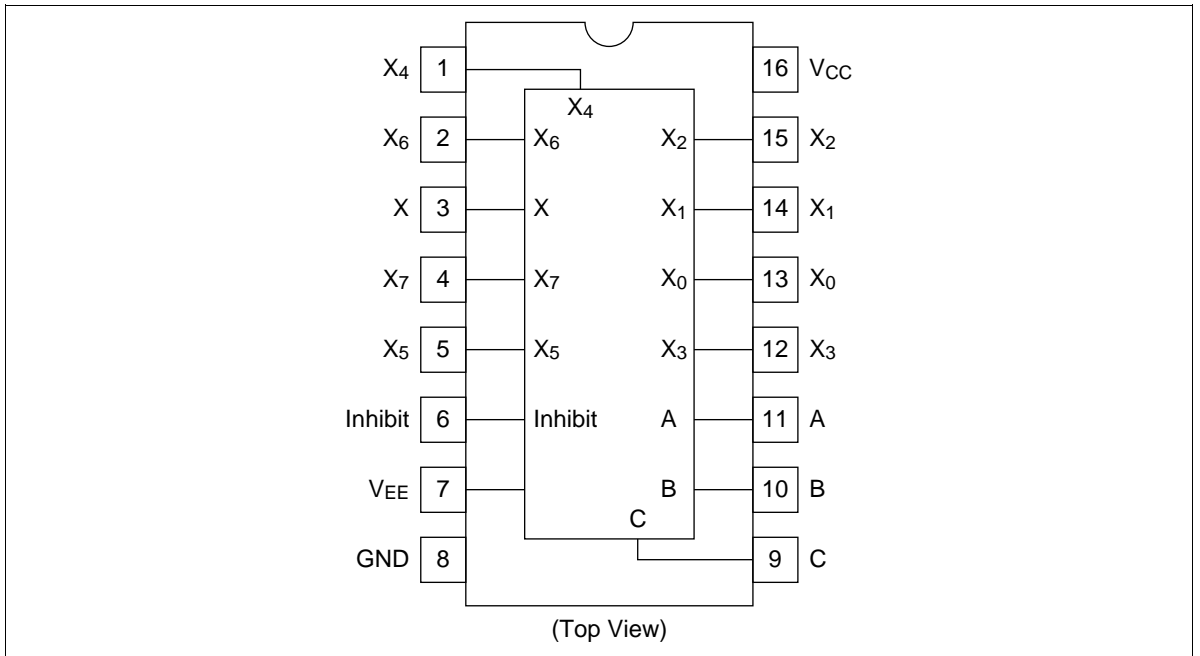
Control Inputs

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

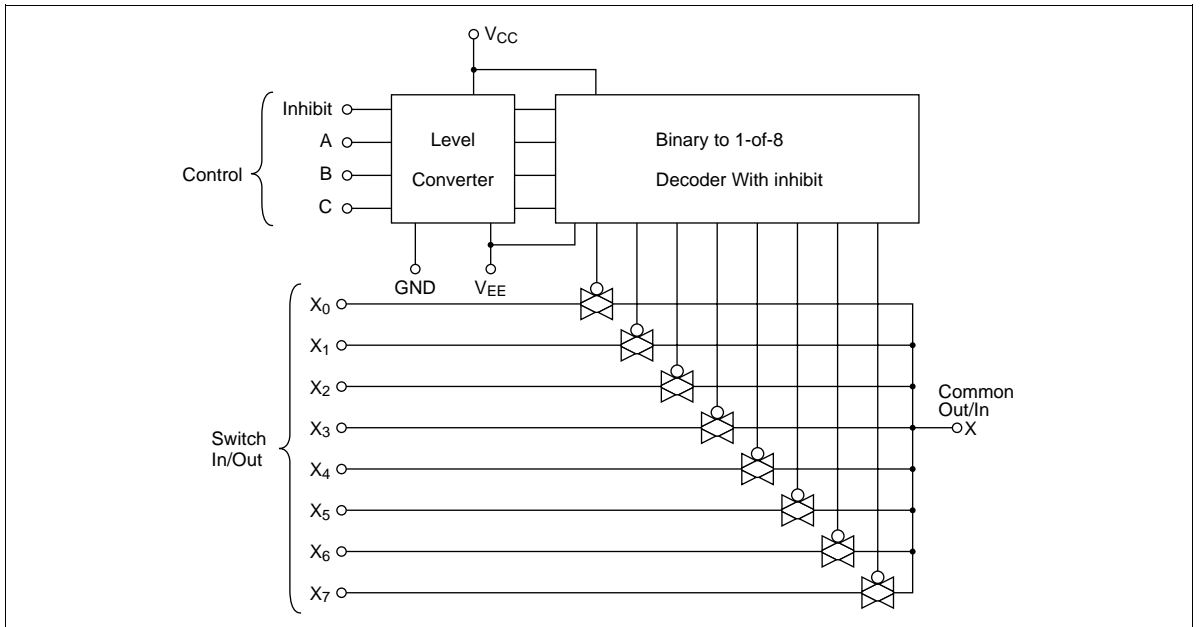
X : Don't Care

HD74HC4051

Pin Arrangement



Block Diagram



HITACHI

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
	$V_{GND} - V_{EE}$	-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

HD74HC4051

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	Ω	$V_{INH} = V_{IL}$	
		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	Ω	$V_{INH} = V_{IL}$
			4.5	—	80	150	—	190		$V_{IO} = V_{CC}$ to V_{EE}
			6.0	—	70	140	—	175		$V_{IO} \leq 2 \text{ mA}$
Δ ON resistance between any two channels	ΔR_{ON}	2.0	—	50	—	—	—	Ω	$V_{INH} = V_{IL}$	
		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	—	—	± 0.1	—	± 1.0	μA	$V_{INH} = V_{IL}$	
OFF channel leakage current (switch on)	$I_{S(ON)}$	6.0	—	—	± 0.1	—	± 1.0	μA	$V_{INH} = V_{IL}$	
Control input current	I_{in}	6.0	—	—	± 0.1	—	± 1.0	μA	$V_{in} = V_{CC}$ or V_{SS}	
Quiescent supply current	I_{CC}	6.0	—	—	4.0	—	40	μA	$V_{in} = V_{CC}$ or V_{SS}	

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

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		
Propagation delay time	t_{PLH}	2.0	—	25	60	—	75	ns	$R_L = 10 \text{ k}\Omega$
		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	$R_L = 10 \text{ k}\Omega$
		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	$R_L = 1 \text{ k}\Omega$
		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	$R_L = 1 \text{ k}\Omega$
		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	

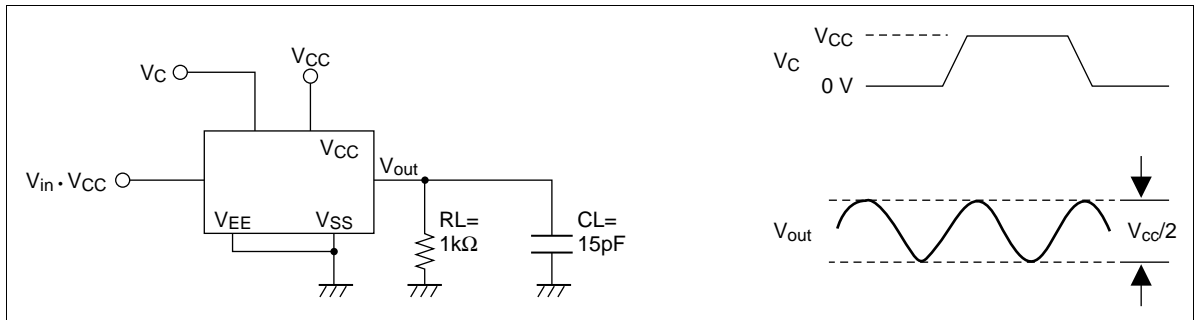
HD74HC4051

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

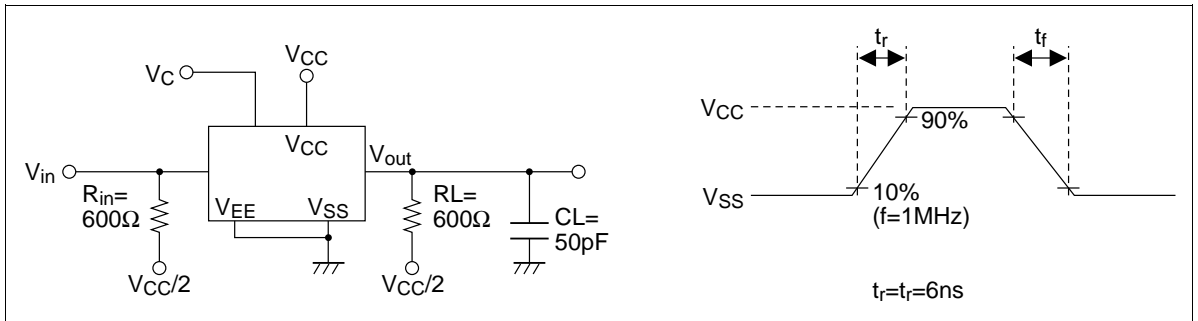
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Sine wave distortion		4.5	—	0.1	—	—	—	%	$f_{in} = 1 \text{ kHz}$, $V_{in} = 4 V_{P-P}$ $R_L = 10 \text{ k}\Omega$, $C_L = 50 \text{ pF}$
Frequency response channel "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

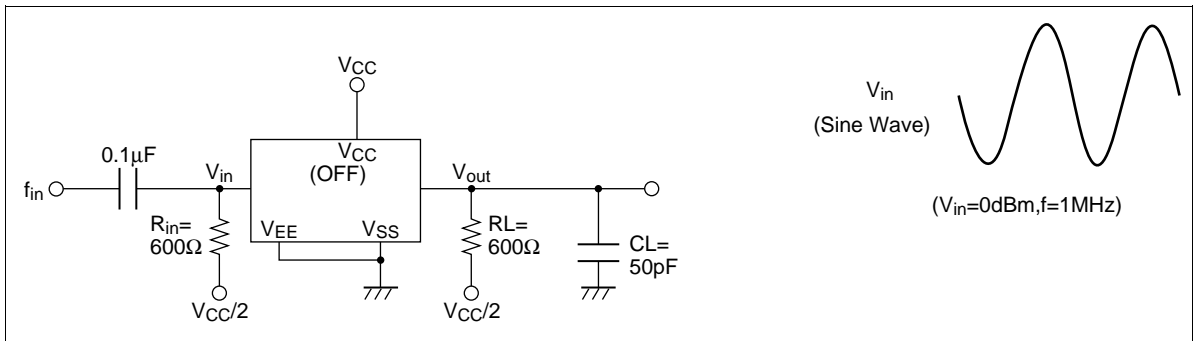
Maximum Control Frequency



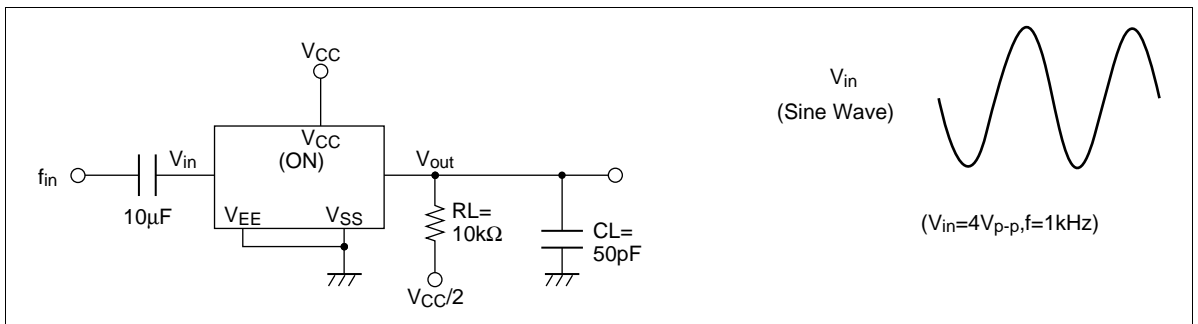
Cross talk (Control Input to Switch Output)



Feed through Attenuation

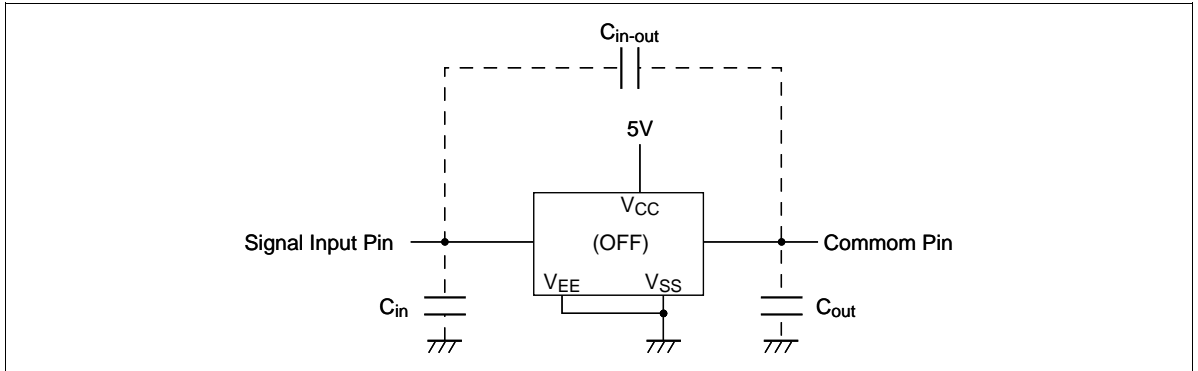


Sine Wave Distortion

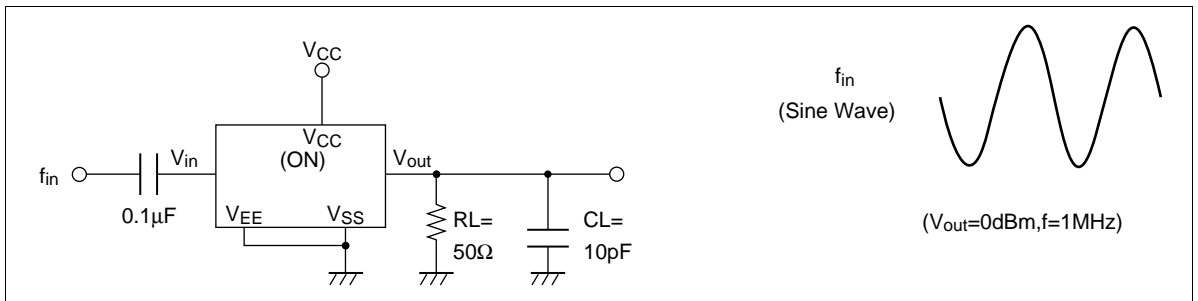


HD74HC4051

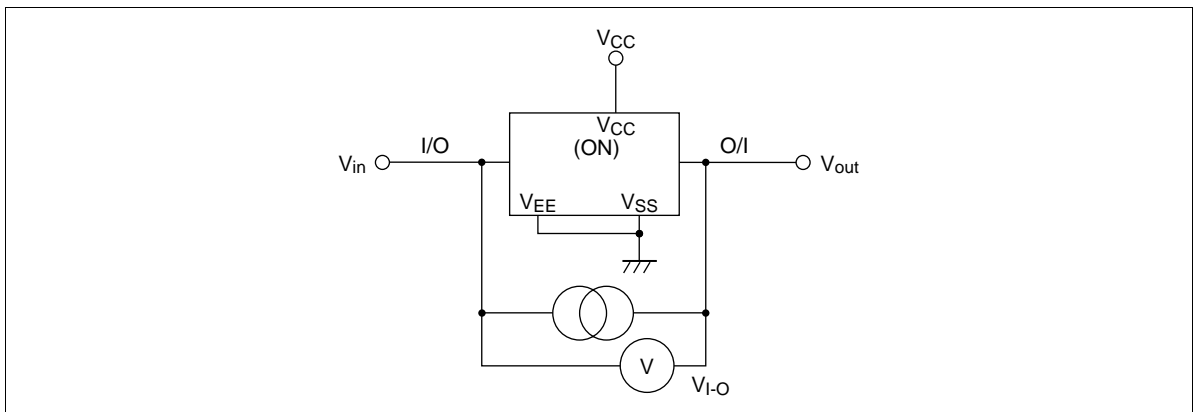
C_{in}, C_{out}, C_{in-out} (Input, Output, and Feed through Capacitance)



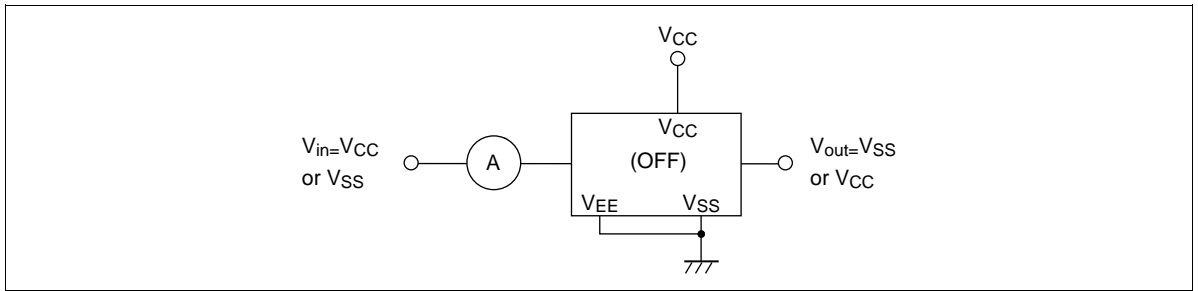
Frequency Response Channel ON



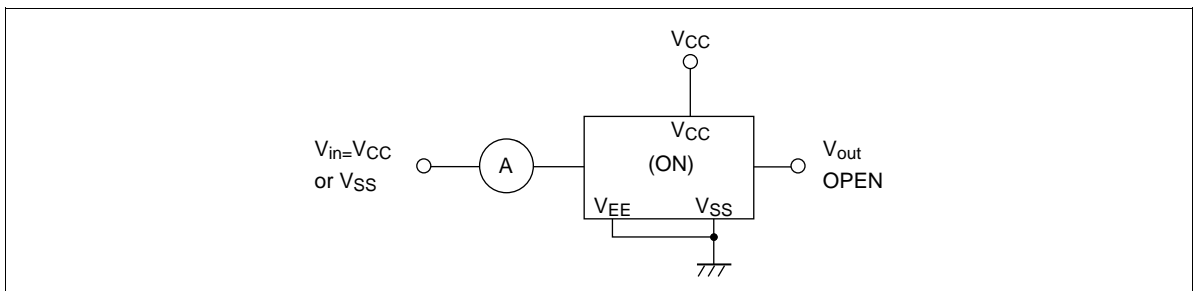
R_{ON}: ON Resistance



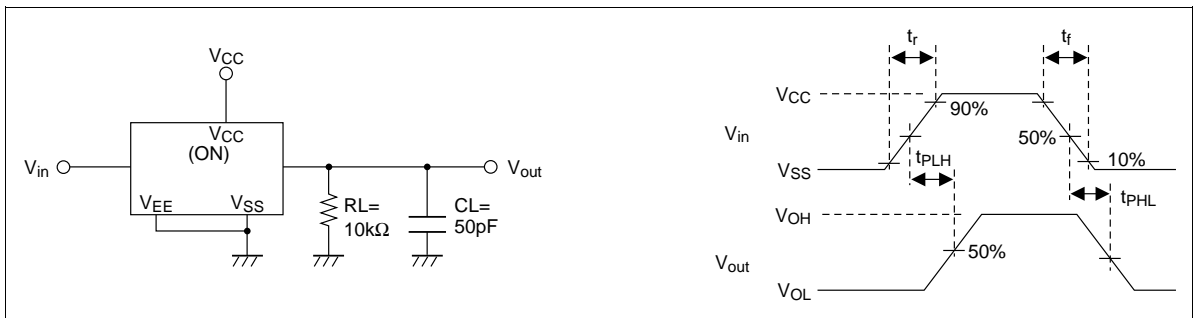
I_s (OFF): OFF Channel Leakage Current (Switch OFF)



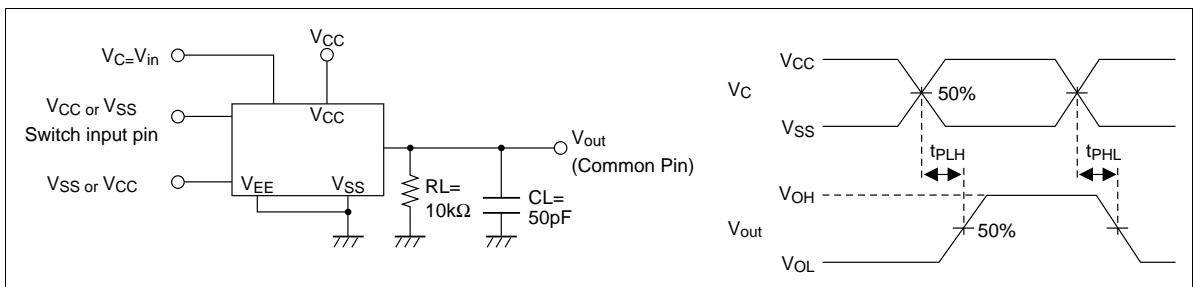
I_s (ON): OFF Channel Leakage Current (Switch ON)



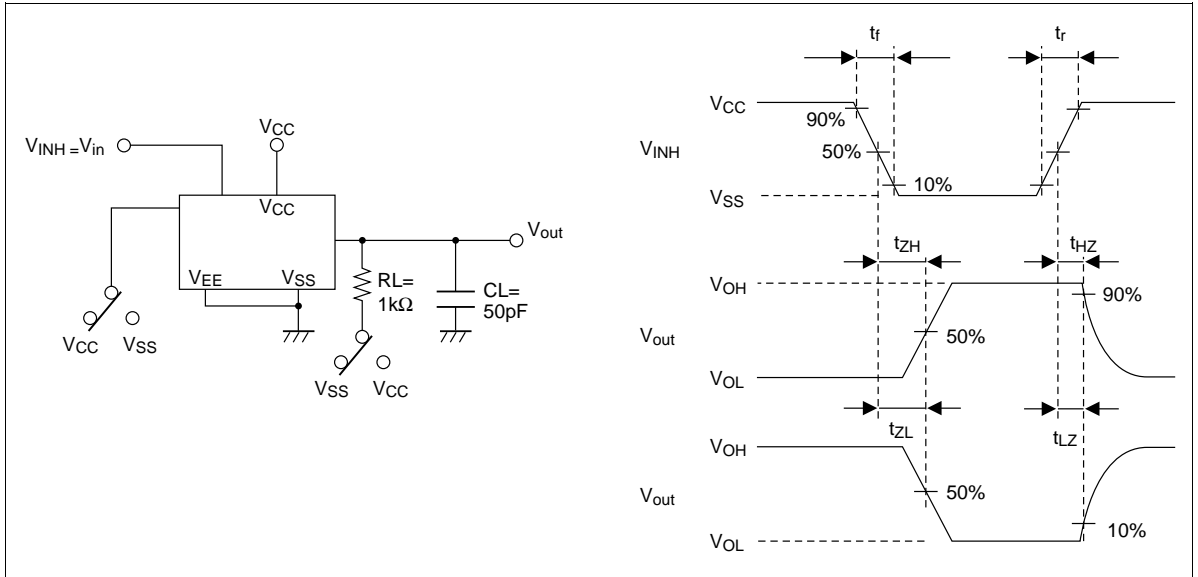
t_{PLH} , t_{PHL} : Propagation Delay Time (Switch Input to Switch Output)



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





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

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL North America : <http://semiconductor.hitachi.com/>
 Europe : <http://www.hitachi-eu.com/hel/ecg>
 Asia (Singapore) : <http://www.has.hitachi.com.sg/grp3/sicd/index.htm>
 Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
 Asia (HongKong) : <http://www.hitachi.com.hk/eng/bo/grp3/index.htm>
 Japan : <http://www.hitachi.co.jp/Sicd/indx.htm>

For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

Copyright ' Hitachi, Ltd., 1999. All rights reserved. Printed in Japan.

HITACHI