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

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HD74HC4051

8-Channel Analog Multiplexer Demultiplexer



ADE-205-535 (Z)
1st. Edition
Sep. 2000

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

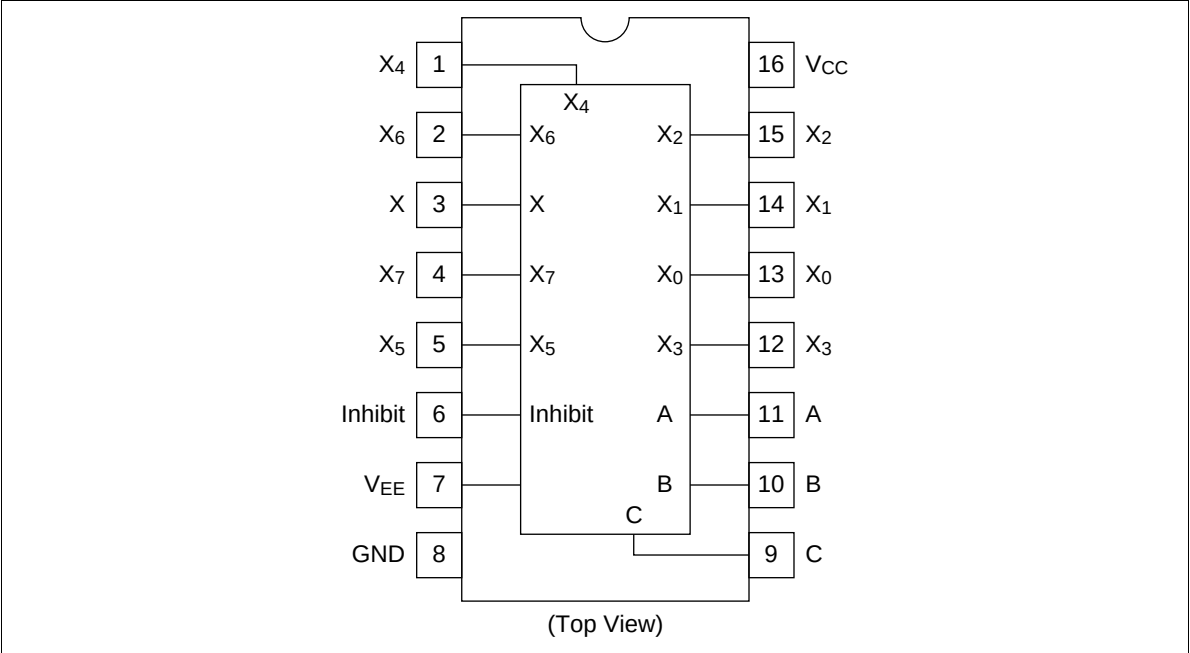
Function Table

Control Inputs

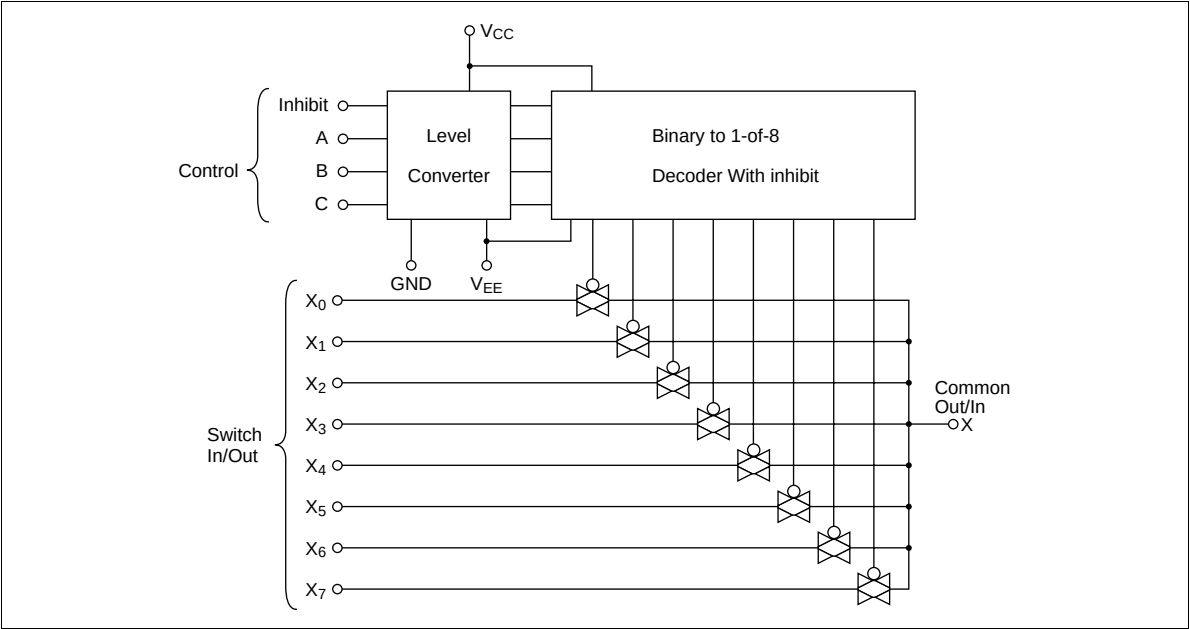
Inhibit	C	B	A	ON Switch
L	L	L	L	X ₀
L	L	L	H	X ₁
L	L	H	L	X ₂
L	L	H	H	X ₃
L	H	L	L	X ₄
L	H	L	H	X ₅
L	H	H	L	X ₆
L	H	H	H	X ₇
H	X	X	X	—

X : Don't Care

Pin Arrangement



Block Diagram



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		T_{stg}	−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		T_{opr}	−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 _{CC} (V)	Ta = 25°C			Ta = −40 to +85°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 _{I/O} = V _{CC} to V _{EE}
		6.0	—	100	170	—	210		I _{I/O} ≤ 2 mA
		2.0	—	200	800	—	1000	Ω	V _{INH} = V _{IL}
		4.5	—	80	150	—	190		V _{I/O} = V _{CC} to V _{EE}
		6.0	—	70	140	—	175		V _{I/O} ≤ 2 mA
ΔON resistance between any two channels	ΔR _{ON}	2.0	—	50	—	—	—	Ω	V _{INH} = V _{IL}
		4.5	—	13	40	—	50		V _{I/O} = V _{CC} to V _{EE}
		6.0	—	10	20	—	25		I _{I/O} ≤ 2 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 GND
Quiescent supply current	I _{CC}	6.0	—	—	4.0	—	40	μA	V _{in} = V _{CC} or GND

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

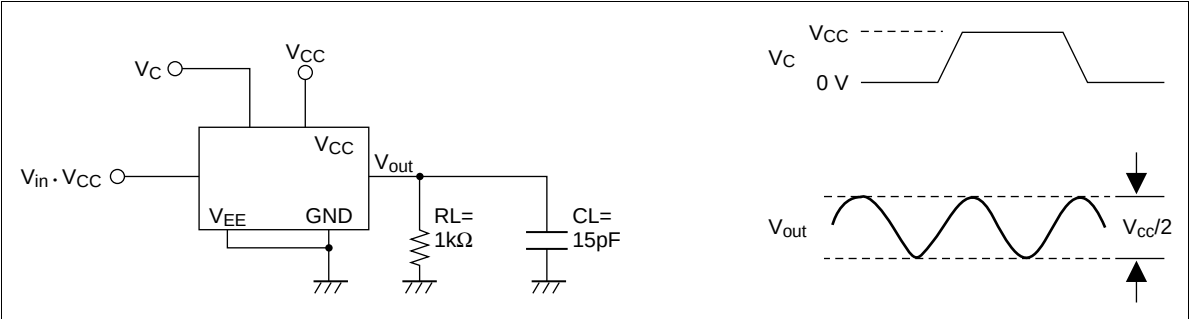
Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = −40 to +85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	t _{PLH}	2.0	—	25	60	—	75	ns	R _L = 10 kΩ
		4.5	—	6	12	—	15		Switch input to switch output
		6.0	—	5	10	—	13		
	t _{PHL}	2.0	—	25	60	—	75	ns	
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
Propagation delay time	t _{PLH}	2.0	—	50	153	—	191	ns	R _L = 10 kΩ
		4.5	—	16	30	—	38		Control input to switch output
		6.0	—	14	26	—	33		
	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 kΩ
		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 kΩ
		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	

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

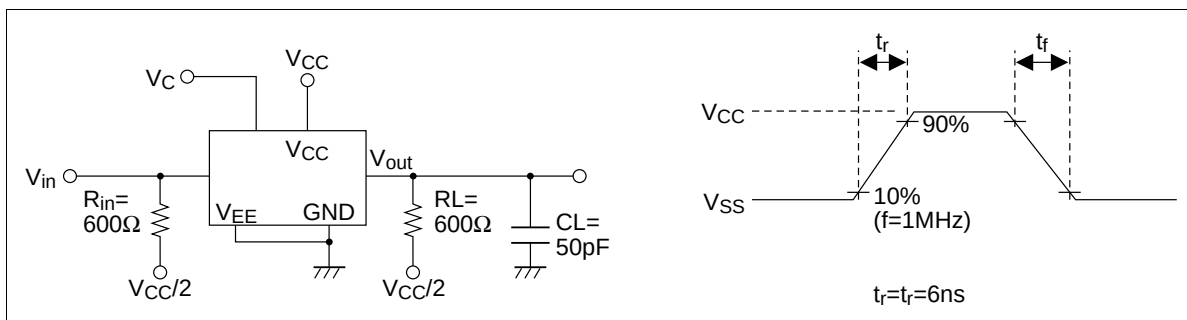
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }+85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Sine wave distortion		4.5	—	0.1	—	—	—	%	$f_{in} = 1\text{ kHz}$, $V_{in} = 4\text{ V}_{P-P}$ $R_L = 10\text{ k}\Omega$, $C_L = 50\text{ pF}$
Frequency response channel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

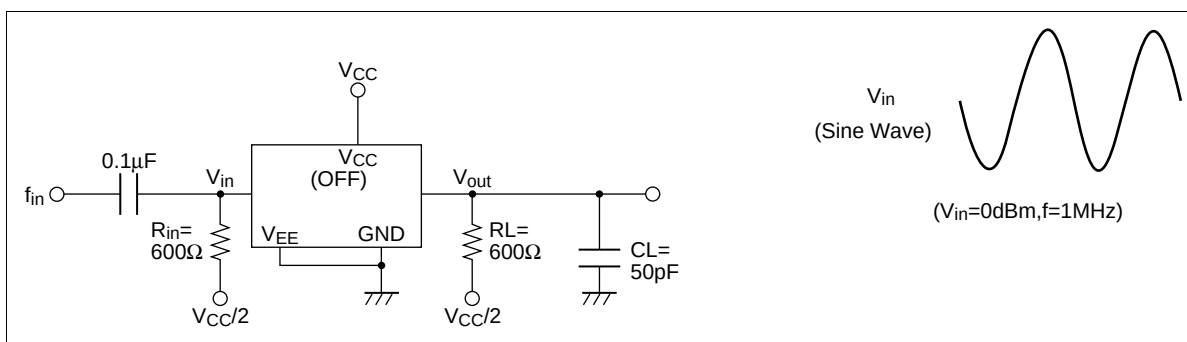
Maximum Control Frequency



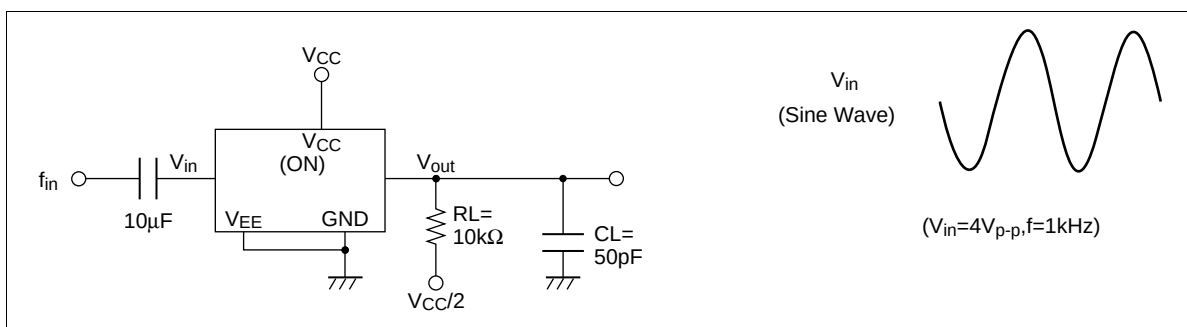
Cross talk (Control Input to Switch Output)



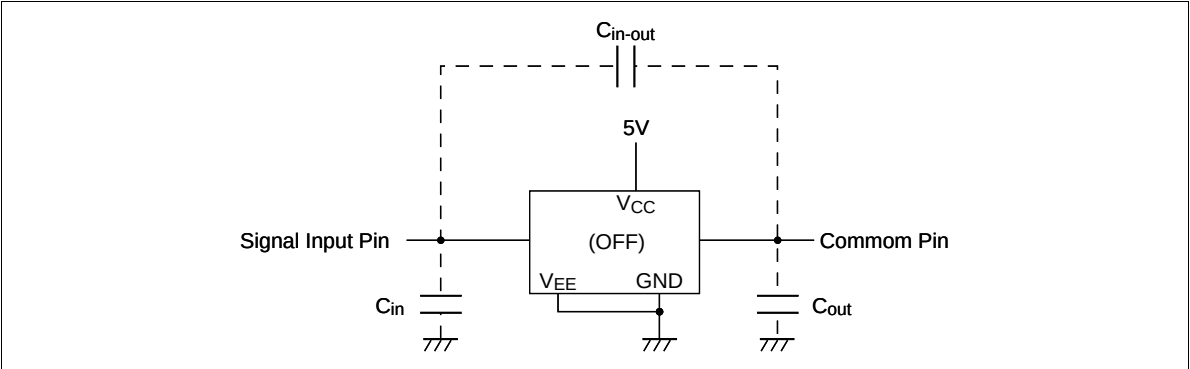
Feed through Attenuation



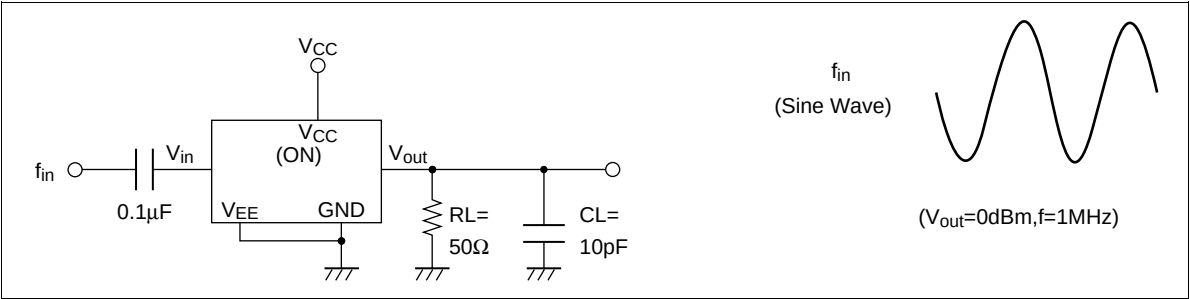
Sine Wave Distortion



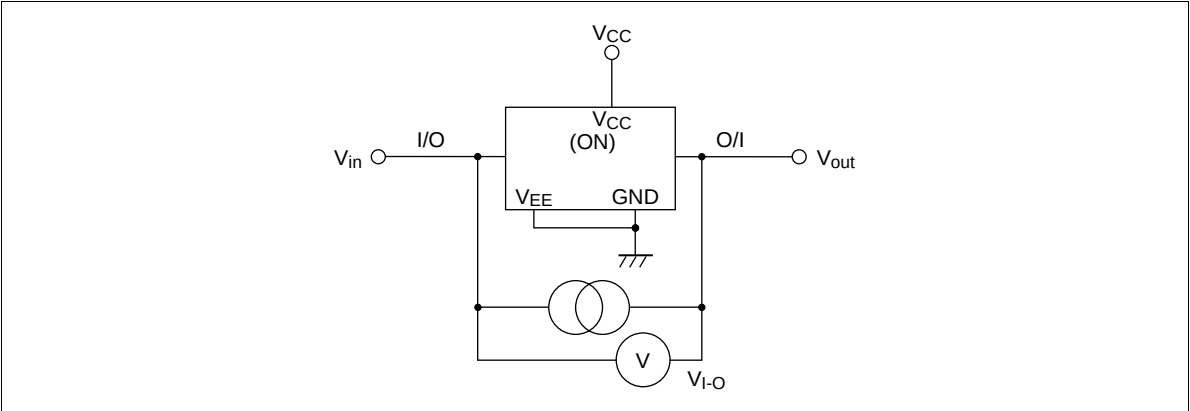
Cin, Cout, Cin-out (Input, Output, and Feed through Capacitance)



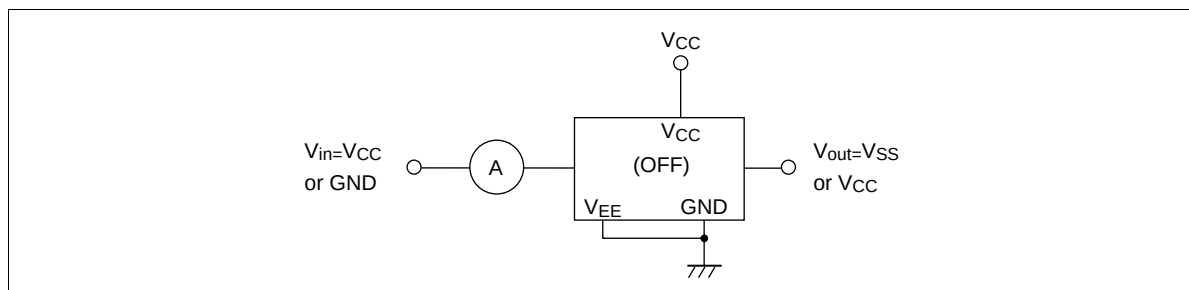
Frequency Response Channel ON



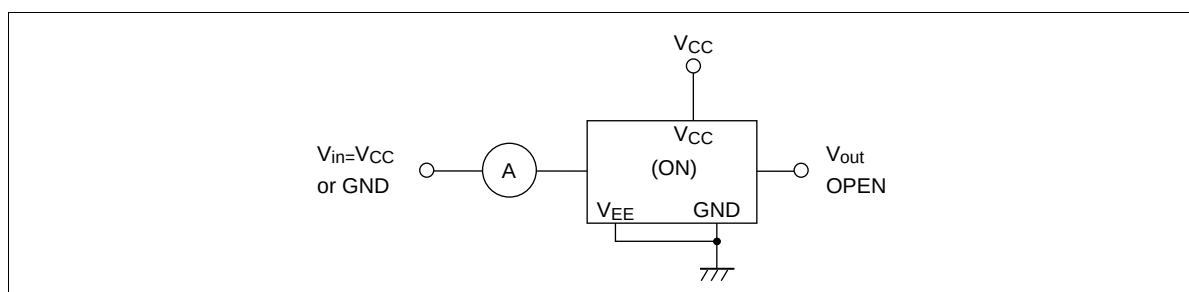
R_{ON}: ON Resistance



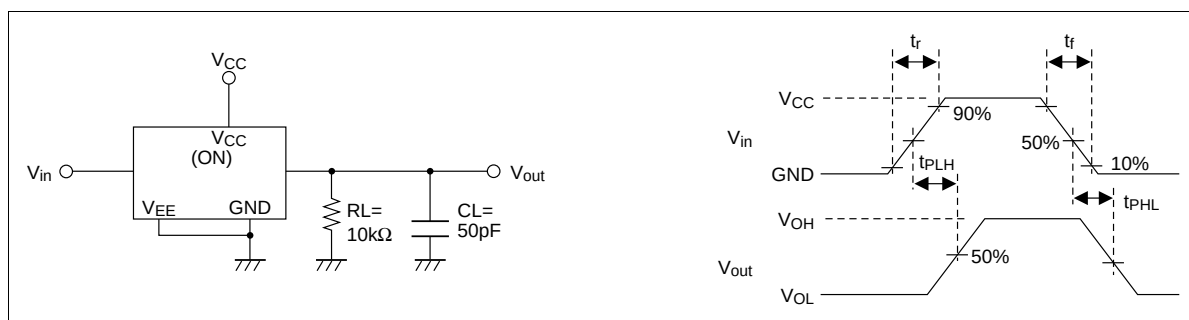
I_s (OFF): OFF Channel Leakage Current (Switch OFF)



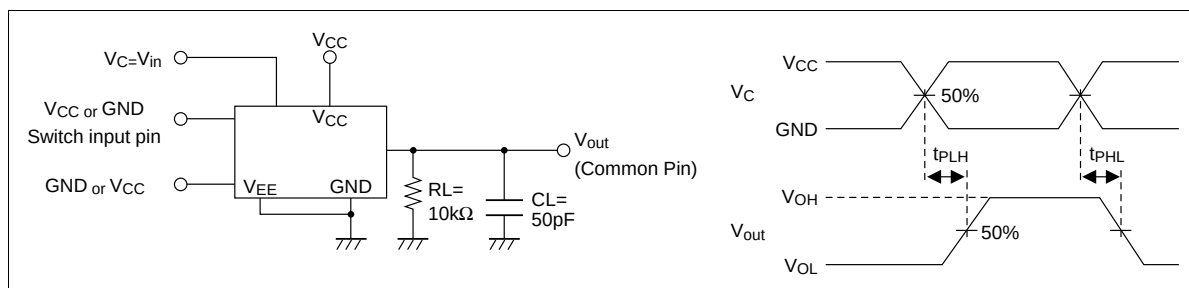
I_s (ON): OFF Channel Leakage Current (Switch ON)



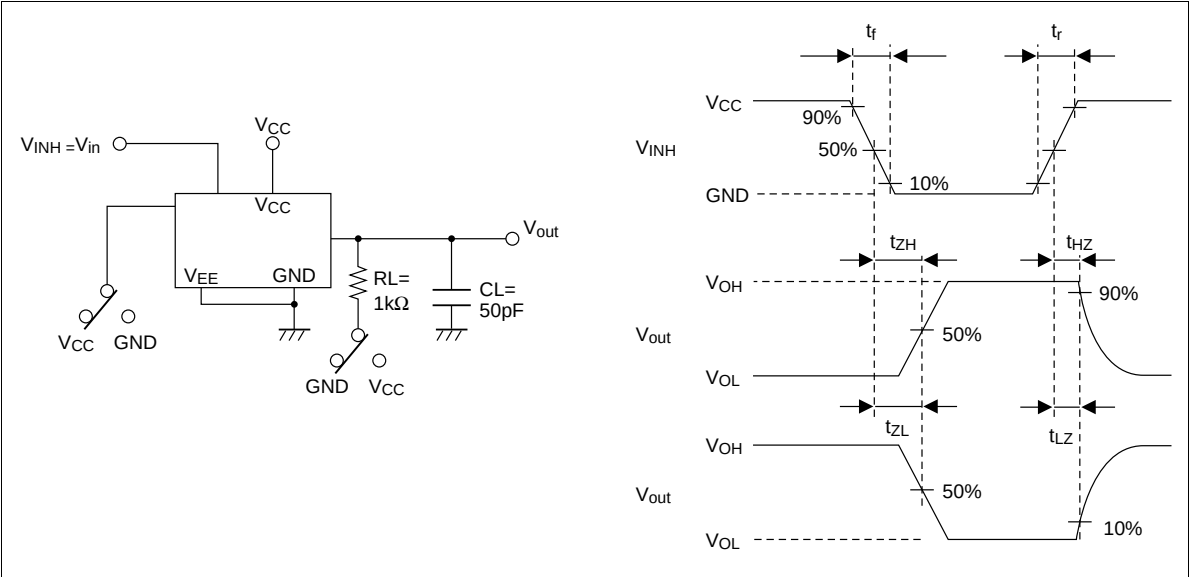
t_{PLH} , t_{PHL} : Propagation Delay Time (Switch Input to Switch Output)



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

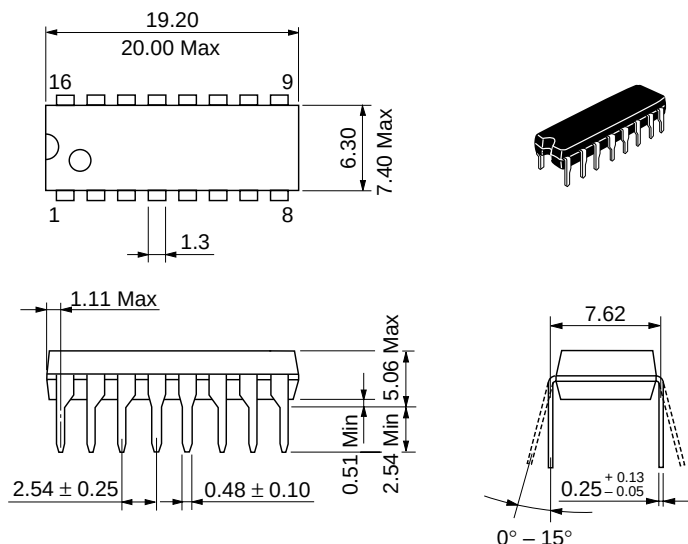


t_{ZH} , t_{ZL}/t_{HZ} , t_{LZ} : Output Enable and Disable Time



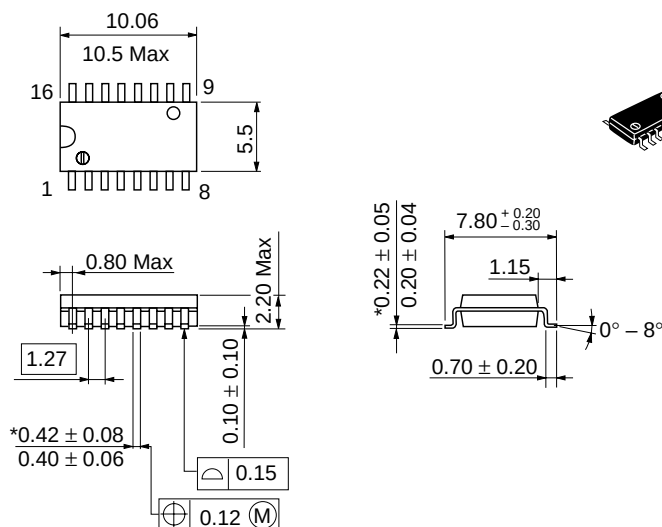
Package Dimensions

Unit: mm



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

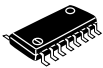
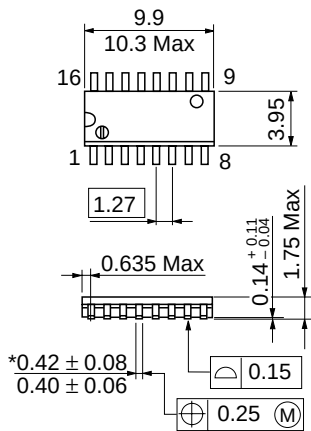
Unit: mm



*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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