

# HD74HC4052, HD74HC4053

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

REJ03D0649-0200  
(Previous ADE-205-536)  
Rev.2.00  
Mar 30, 2006

## 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:  $V_{CC} = 2$  to 6 V
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC4052P HD74HC4053P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74HC4052FPEL HD74HC4053FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)
HD74HC4052RPEL HD74HC4053RPEL	SOP-16 pin (JEDEC)	PRSP0016DG-A (FP-16DNV)	RP	EL (2,500 pcs/reel)

Note: Please consult the sales office for the above package availability.

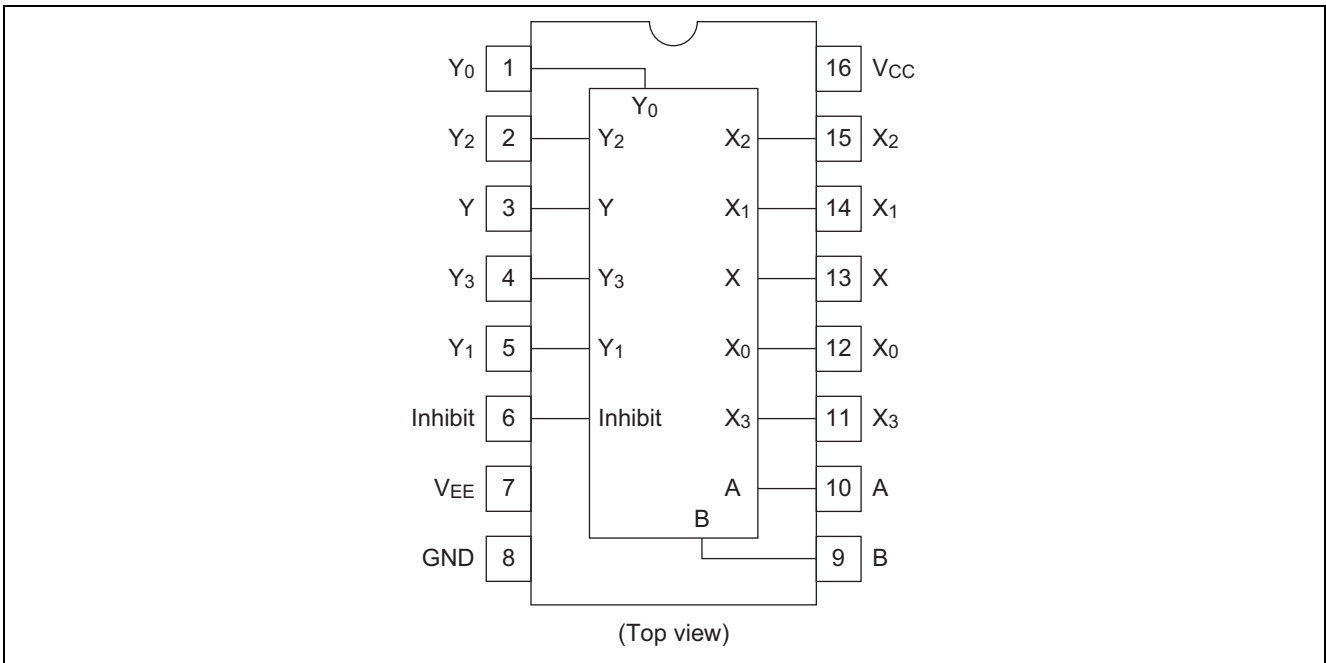
## Function Table

Control Inputs				ON Switch				
Inhibit	Select			HD74HC4052		HD74HC4053		
	$C^{*1}$	B	A	$Y_0$	$X_0$	$Z_0$	$Y_0$	$X_0$
L	L	L	L	$Y_0$	$X_0$	$Z_0$	$Y_0$	$X_0$
L	L	L	H	$Y_1$	$X_1$	$Z_0$	$Y_0$	$X_1$
L	L	H	L	$Y_2$	$X_2$	$Z_0$	$Y_1$	$X_0$
L	L	H	H	$Y_3$	$X_3$	$Z_0$	$Y_1$	$X_1$
L	H	L	L	—	—	$Z_1$	$Y_0$	$X_0$
L	H	L	H	—	—	$Z_1$	$Y_0$	$X_1$
L	H	H	L	—	—	$Z_1$	$Y_1$	$X_0$
L	H	H	H	—	—	$Z_1$	$Y_1$	$X_1$
H	X	X	X	—	—	—	—	—

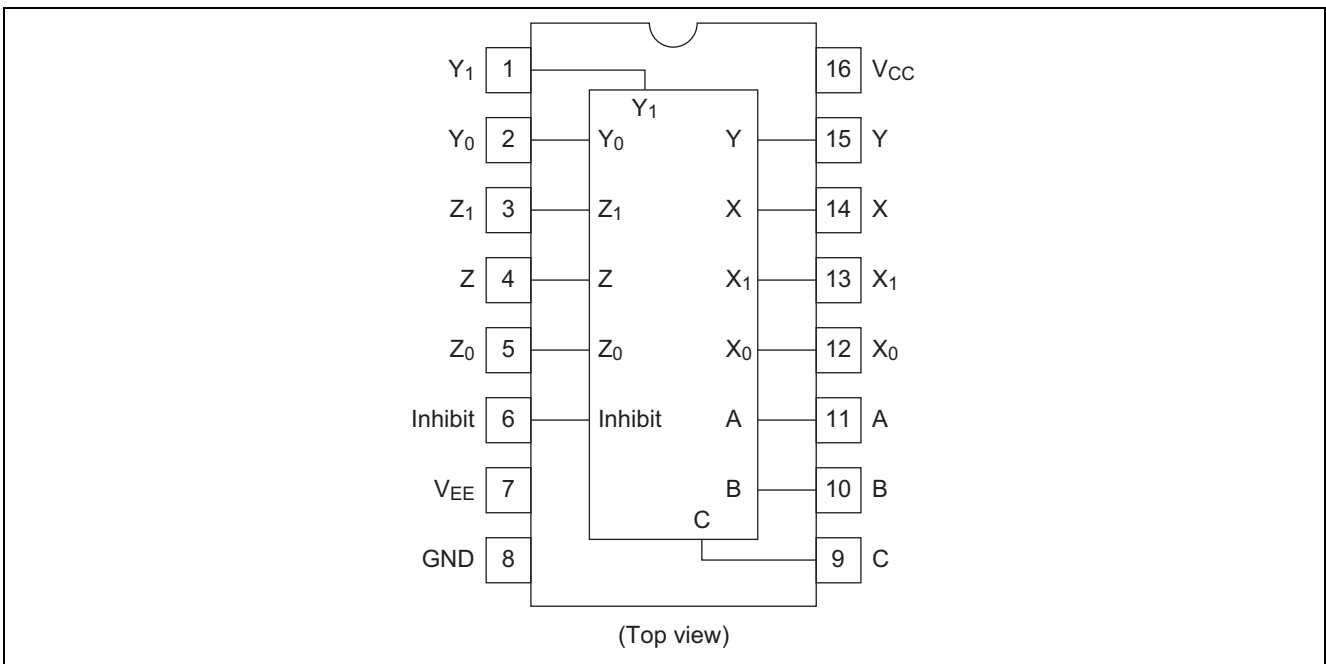
Note: 1. Not applicable for HD74HC4052  
X = Irrelevant

## Pin Arrangement

### HD74HC4052

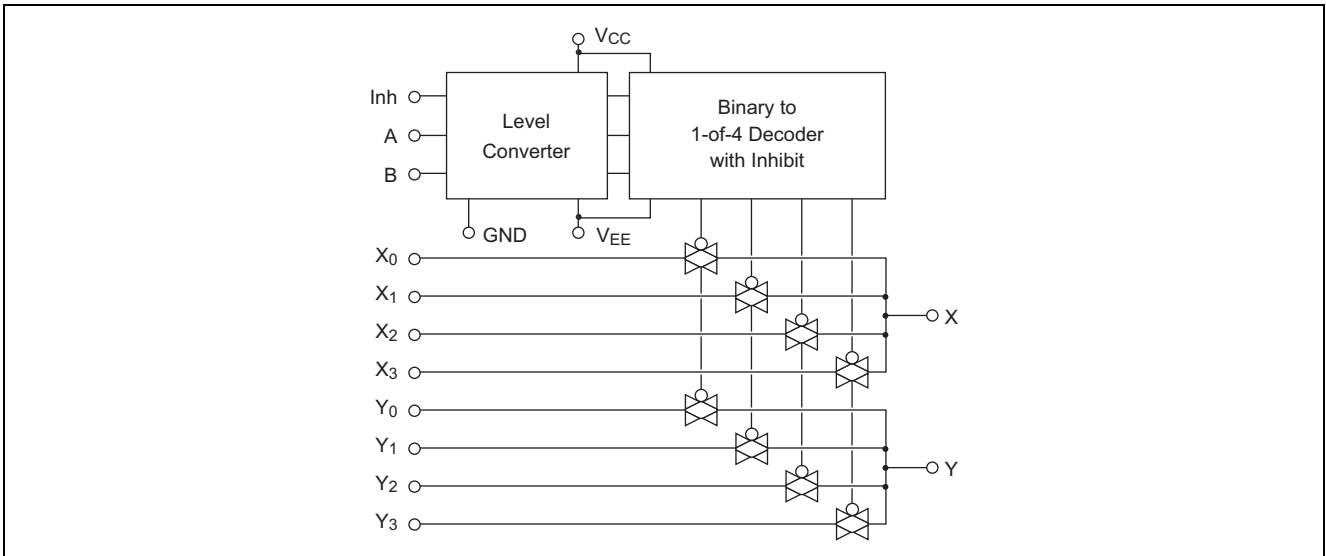


### HD74HC4053

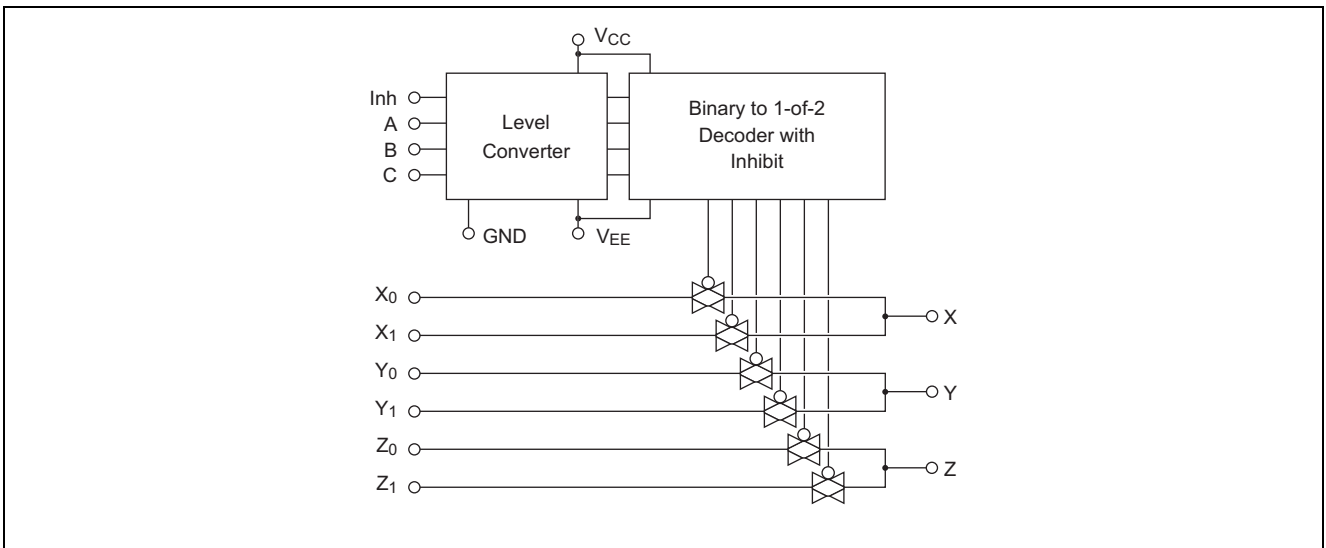


Block Diagram

HD74HC4052



HD74HC4053



Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	-0.5 to +7.0	V
	V <sub>CC</sub> - V <sub>EE</sub>	-0.5 to +7.0	V
Control input voltage	V <sub>IN</sub>	GND - 0.5 to V <sub>CC</sub> + 0.5	V
Switch I/O voltage	V <sub>I/O</sub>	V <sub>EE</sub> - 0.5 to V <sub>CC</sub> + 0.5	V
Supply current	(V <sub>CC</sub> )	I <sub>CC</sub>	+50
	(GND)	I <sub>GND</sub>	-50
Switch I/O current (per pin)	I <sub>I/O</sub>	±25	mA
Control input diode current	I <sub>IK</sub>	±20	mA
Switch I/O diode current	I <sub>IOK</sub>	±20	mA
Power dissipation	P <sub>T</sub>	500	mW
Storage temperature range	T <sub>stg</sub>	-65 to +150	°C

### Recommended Operating Conditions

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

### Electrical Characteristics ( $V_{EE} = GND$ )

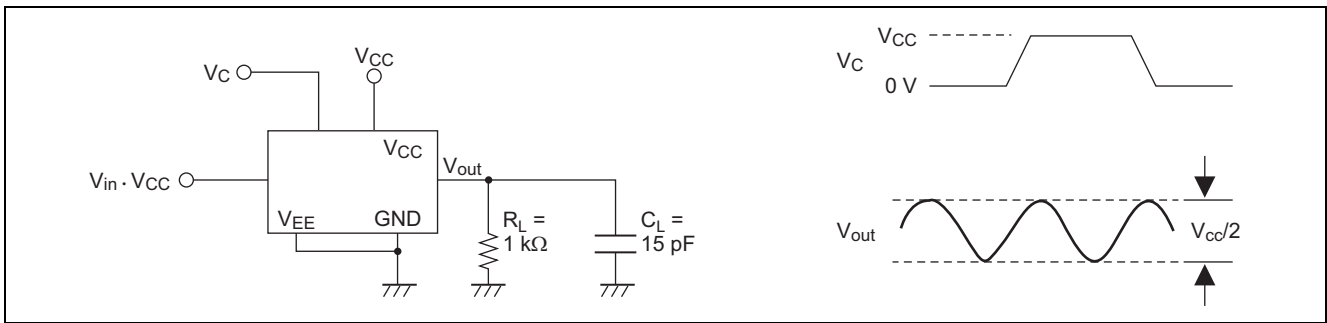
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }+85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Control input voltage	$V_{IH}$	2.0	1.5	—	—	1.5	—	V	
		4.5	3.15	—	—	3.15	—		
		6.0	4.2	—	—	4.2	—		
	$V_{IL}$	2.0	—	—	0.5	—	0.5	V	
		4.5	—	—	1.35	—	1.35		
		6.0	—	—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

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

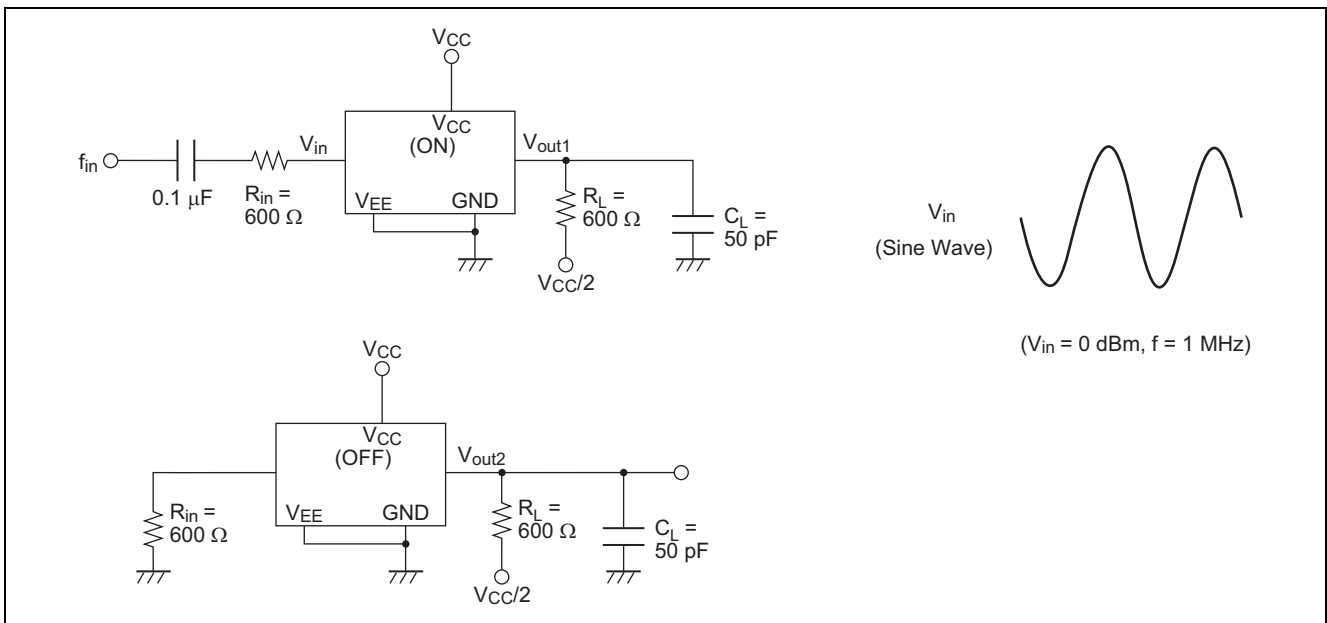
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	$t_{PLH}$	2.0	—	25	60	—	75	ns	$R_L = 10 \text{ k}\Omega$ Switch input to switch output
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
	$t_{PHL}$	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	$R_L = 10 \text{ k}\Omega$ Control input to switch output
		4.5	—	16	30	—	38		
		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	$R_L = 1 \text{ k}\Omega$
		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	—	12	—	—	—	pF	HD74HC4052
		5.0	—	6	—	—	—		HD74HC4053
Feed through capacitance	$C_{in-out}$	5.0	—	0.6	—	—	—	pF	HD74HC4052
		5.0	—	0.5	—	—	—		HD74HC4053
Power dissipation capacitance	$C_{PD}$	5.0	—	32.0	—	—	—	pF	HD74HC4052
		5.0	—	17.0	—	—	—		HD74HC4053
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	$f_{in} = 1 \text{ MHz}$ , $20 \log_{10} V_{OS}/V_{IS} = -3 \text{ dB}$ $R_L = 50 \Omega$ , $C_L = 10 \text{ pF}$
Feed through attenuation		4.5	—	-50	—	—	—	dB	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ , $f_{in} = 1 \text{ MHz}$
Cross talk between control input and switch I/O		2.0	—	25	—	—	—	mV	$R_L = 600 \Omega$ , $C_L = 15 \text{ pF}$ , $f_{in} = 1 \text{ MHz}$
		4.5	—	50	—	—	—		
		6.0	—	75	—	—	—		
Cross talk between any two switches		4.5	—	-50	—	—	—	dB	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ , $f_{in} = 1 \text{ MHz}$
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	—	—	—		

## Test Circuit

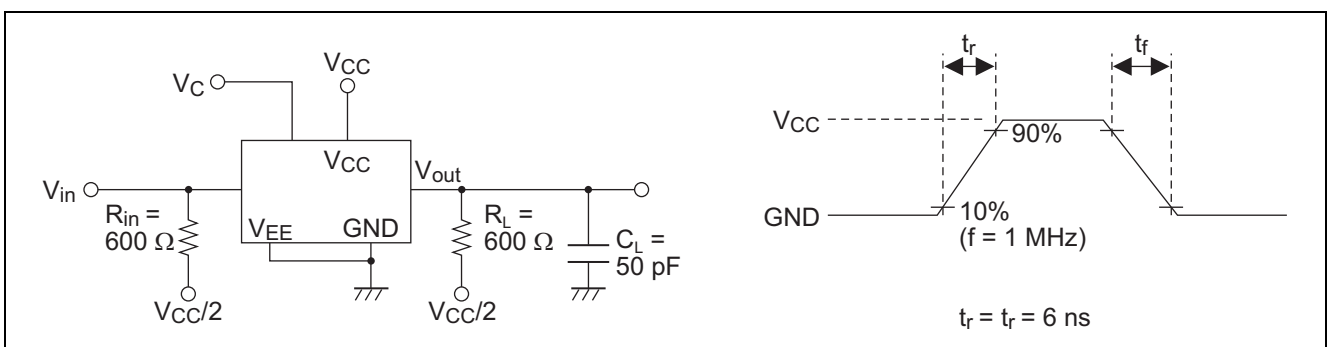
### Maximum Control Frequency



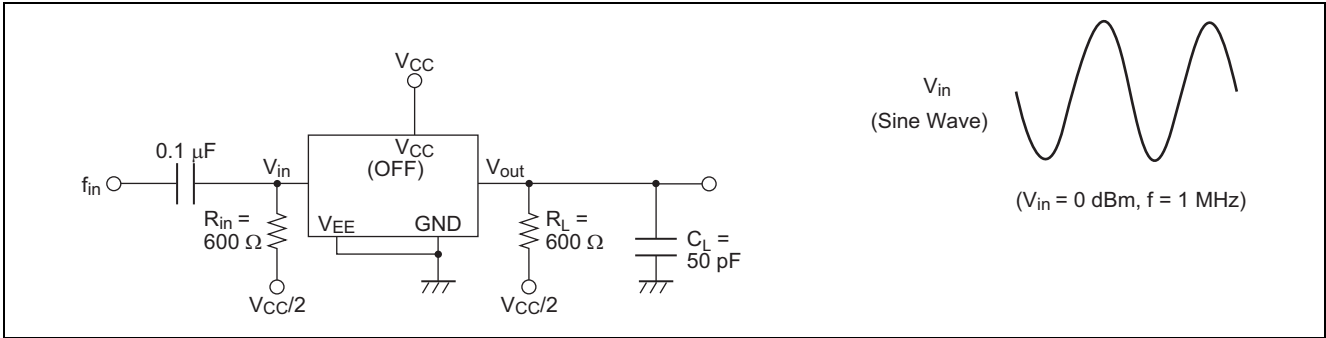
### Cross talk (Between Any Two Switches)



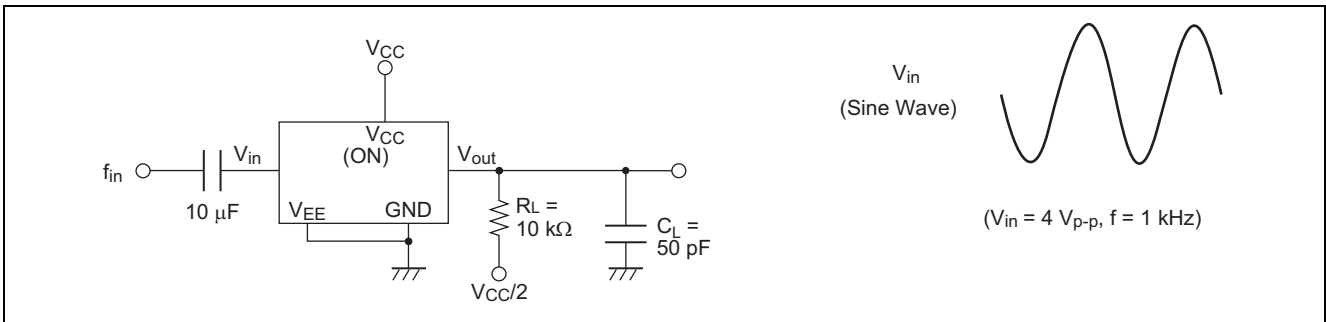
### Cross talk (Control Input to Switch Output)



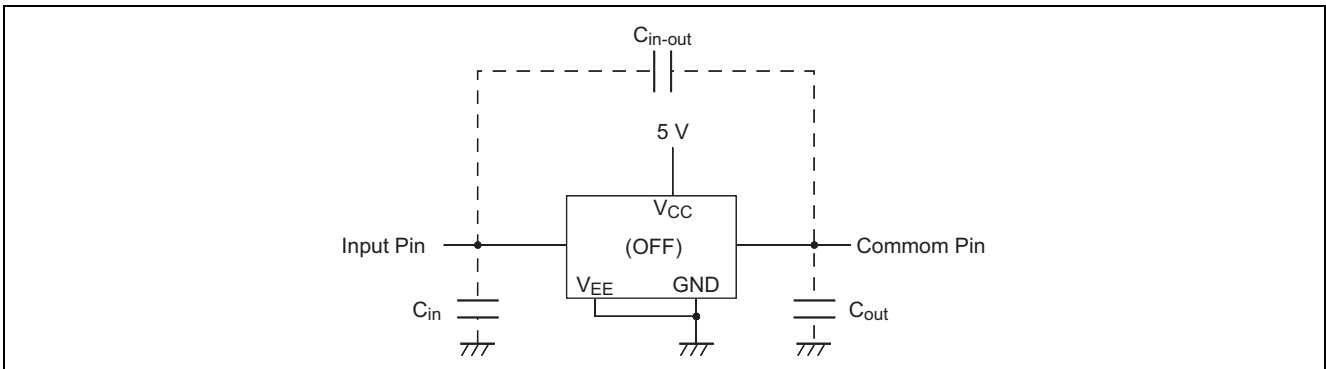
**Feed through Attenuation**



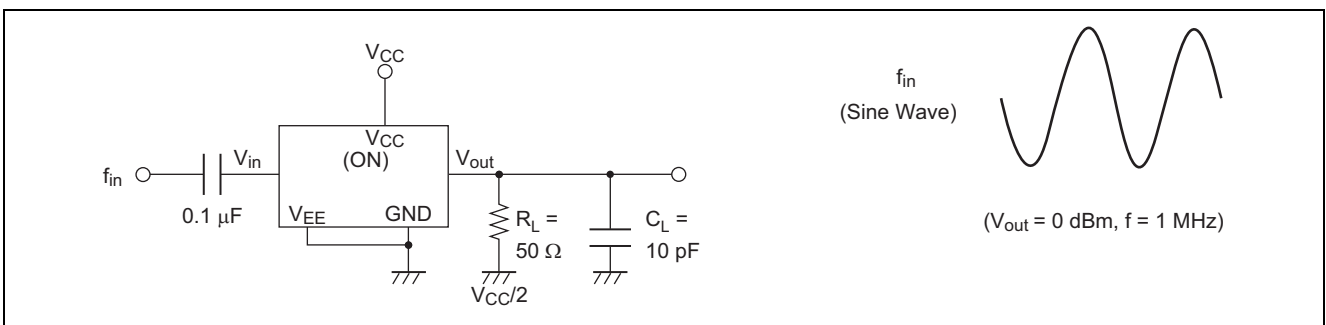
**Sine Wave Distortion**



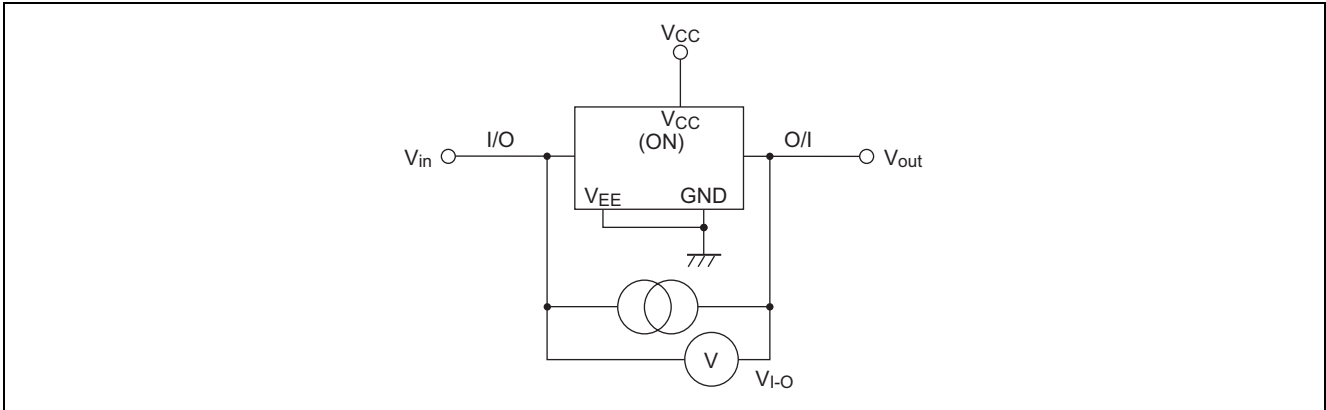
**Cin, Cout, Cin-out (Input, Output, and Feed through Capacitance)**



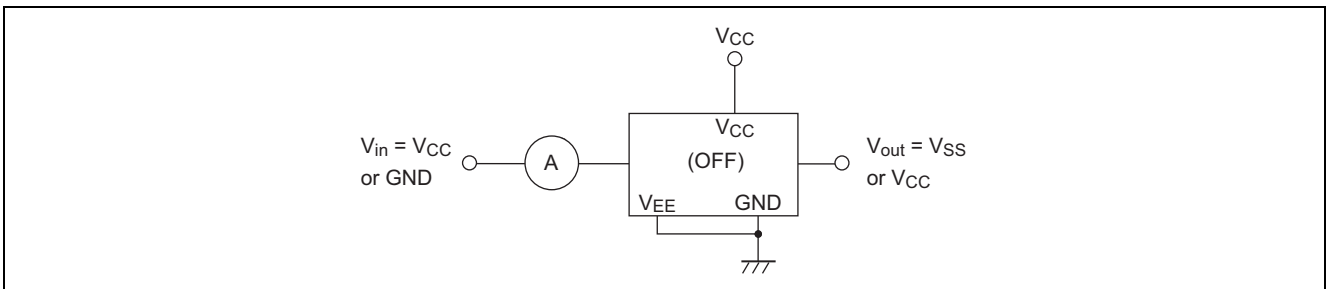
**Frequency Response Channel ON**



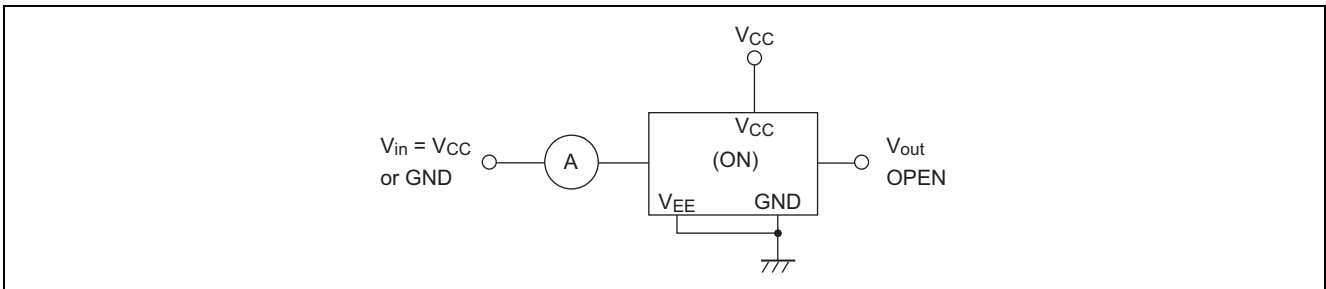
**R<sub>ON</sub>: ON Resistance**



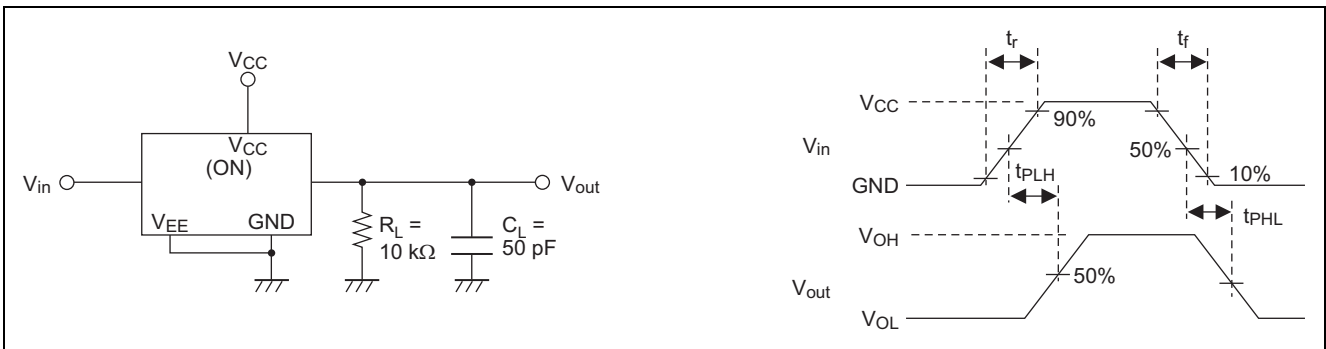
**I<sub>s</sub> (OFF): OFF Channel Leakage Current (Switch OFF)**



**I<sub>s</sub> (ON): OFF Channel Leakage Current (Switch ON)**

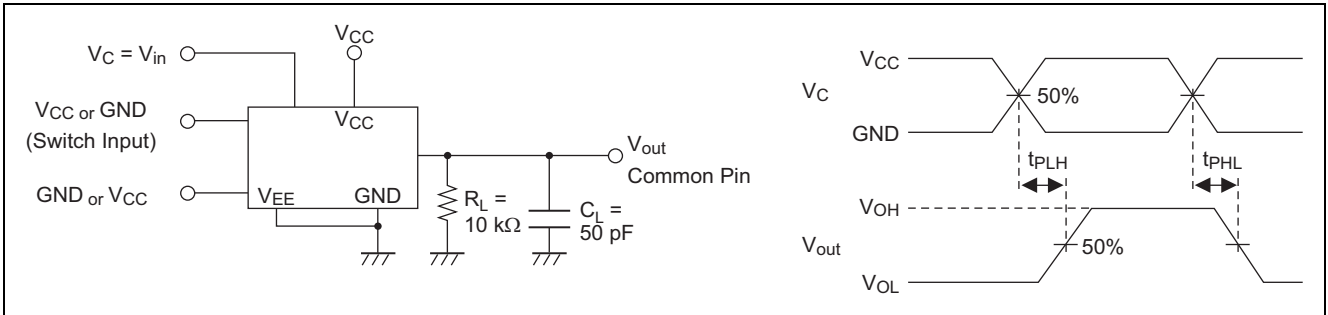


**t<sub>PLH</sub>, t<sub>PHL</sub>: Propagation Delay Time (Switch Input to Switch Output)**

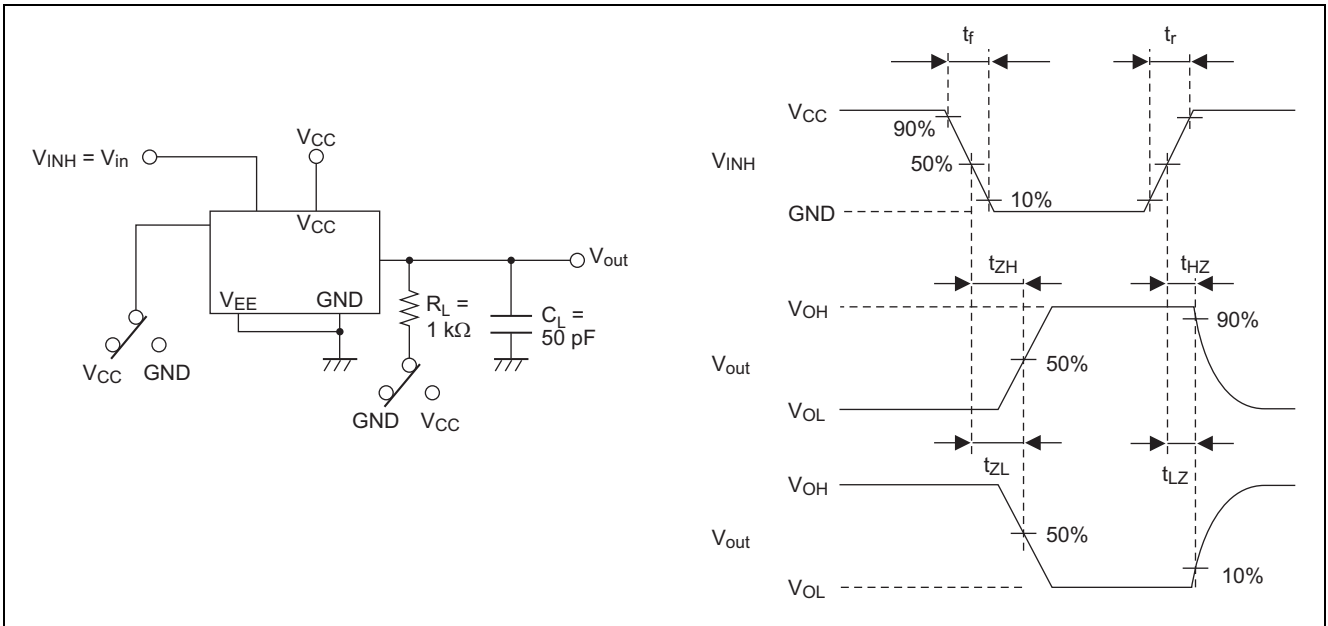




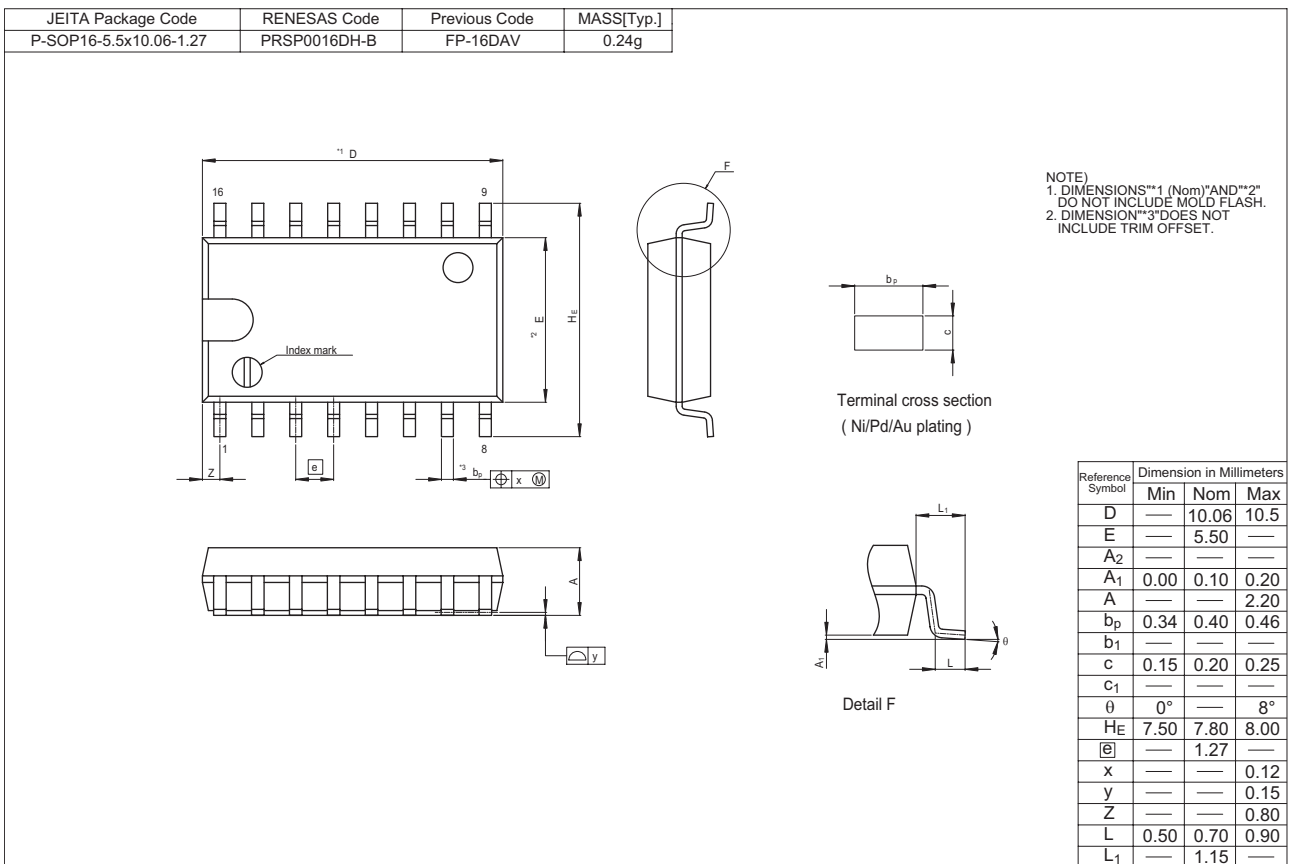
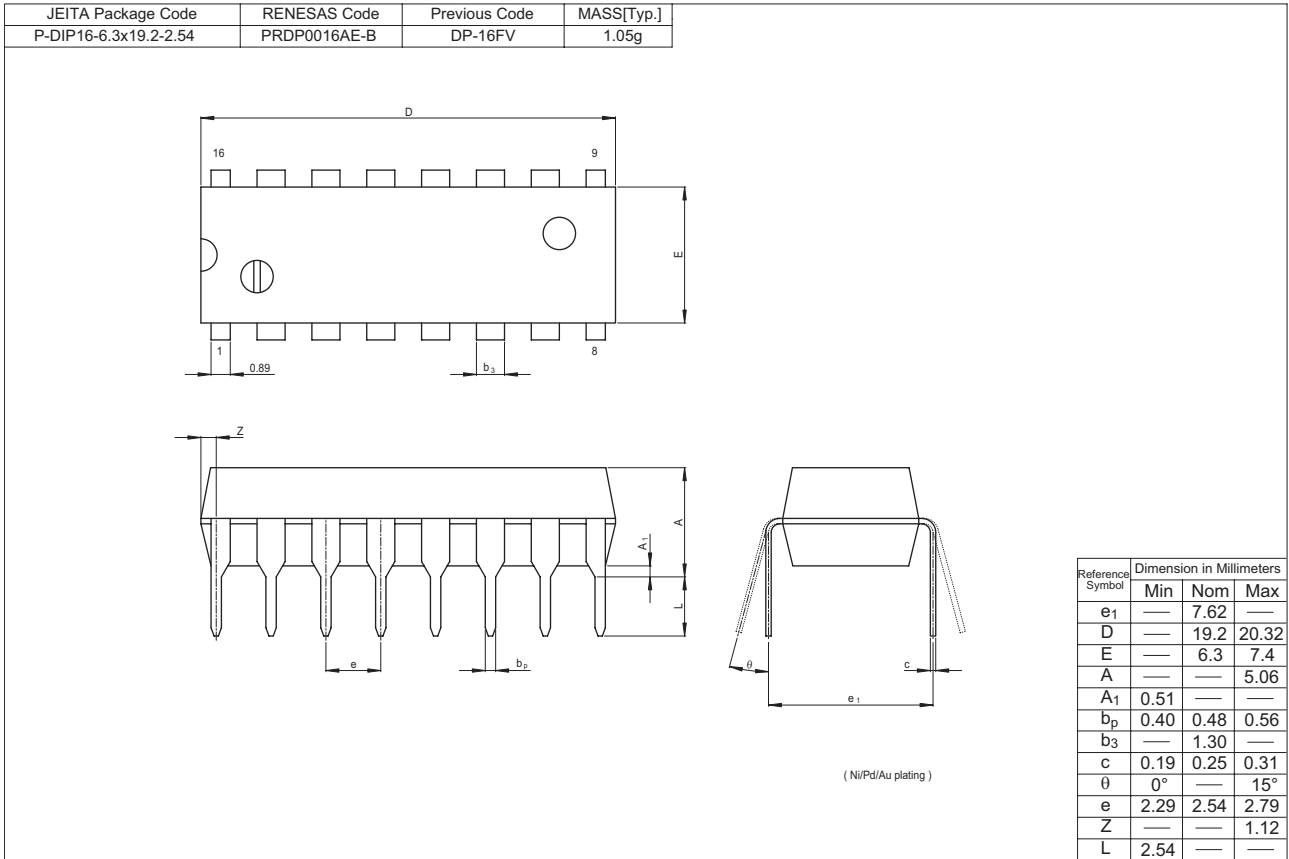
**$t_{PLH}$ ,  $t_{PHL}$ : Propagation Delay Time (Control Input to Switch Output)**



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

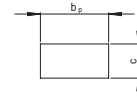
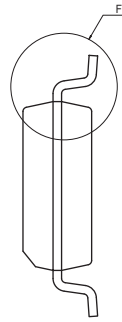
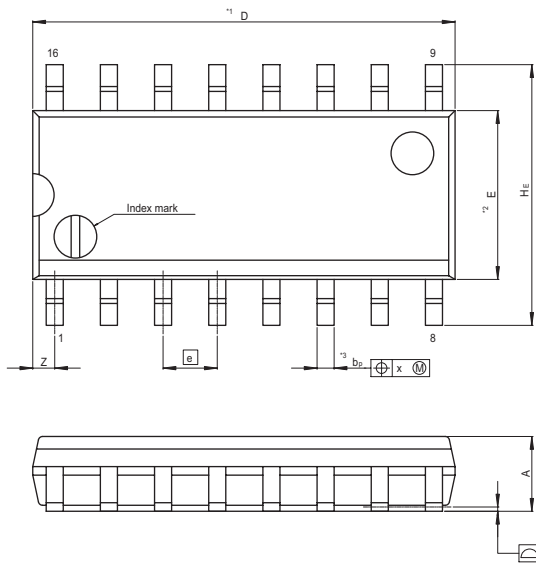


### Package Dimensions

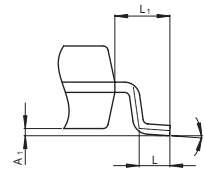


# HD74HC4052, HD74HC4053

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-3.95x9.9-1.27	PRSP0016DG-A	FP-16DNV	0.15g



Terminal cross section  
(Ni/Pd/Au plating)



Detail F

NOTE)  
1. DIMENSIONS\*\*1 (Nom)\*\*AND\*\*2\*  
DO NOT INCLUDE MOLD FLASH.  
2. DIMENSION\*\*3\*DOES NOT  
INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	9.90	10.30
E	—	3.95	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.10	0.14	0.25
A	—	—	1.75
b <sub>p</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
HE	5.80	6.10	6.20
Ⓢ	—	1.27	—
x	—	—	0.25
y	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L <sub>1</sub>	—	1.08	—

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