

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 μ 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.

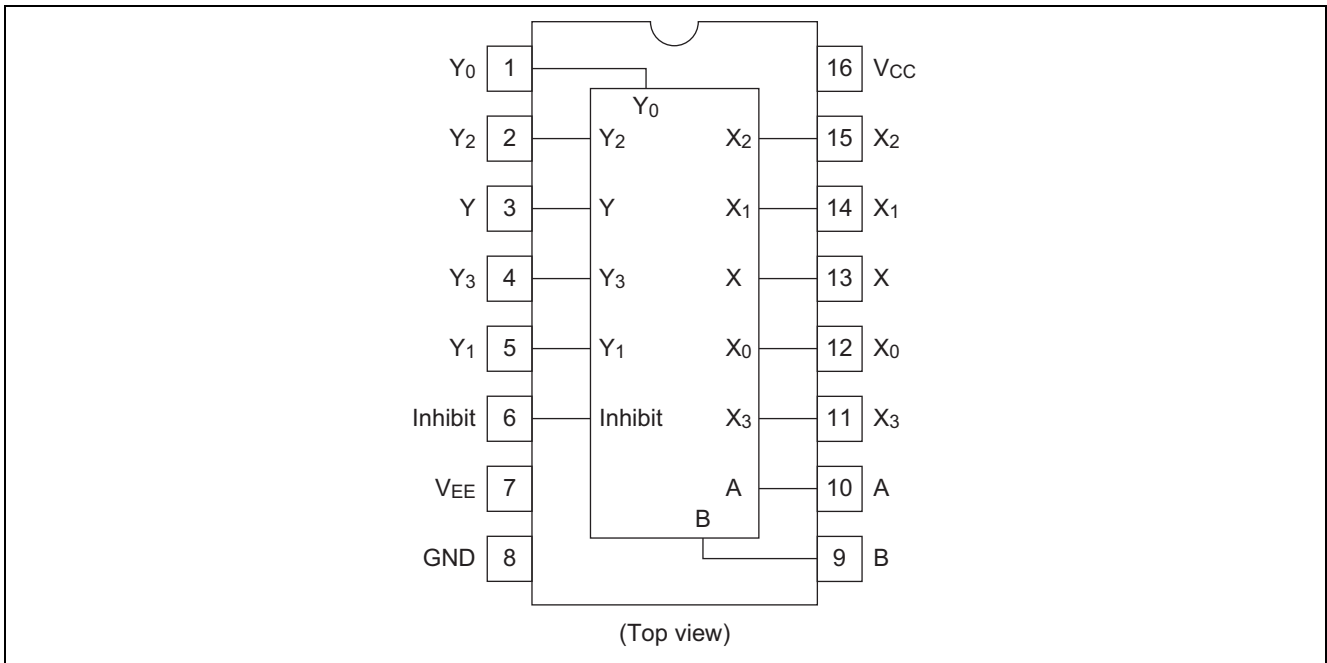
Function Table

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	—	—	—	—	—

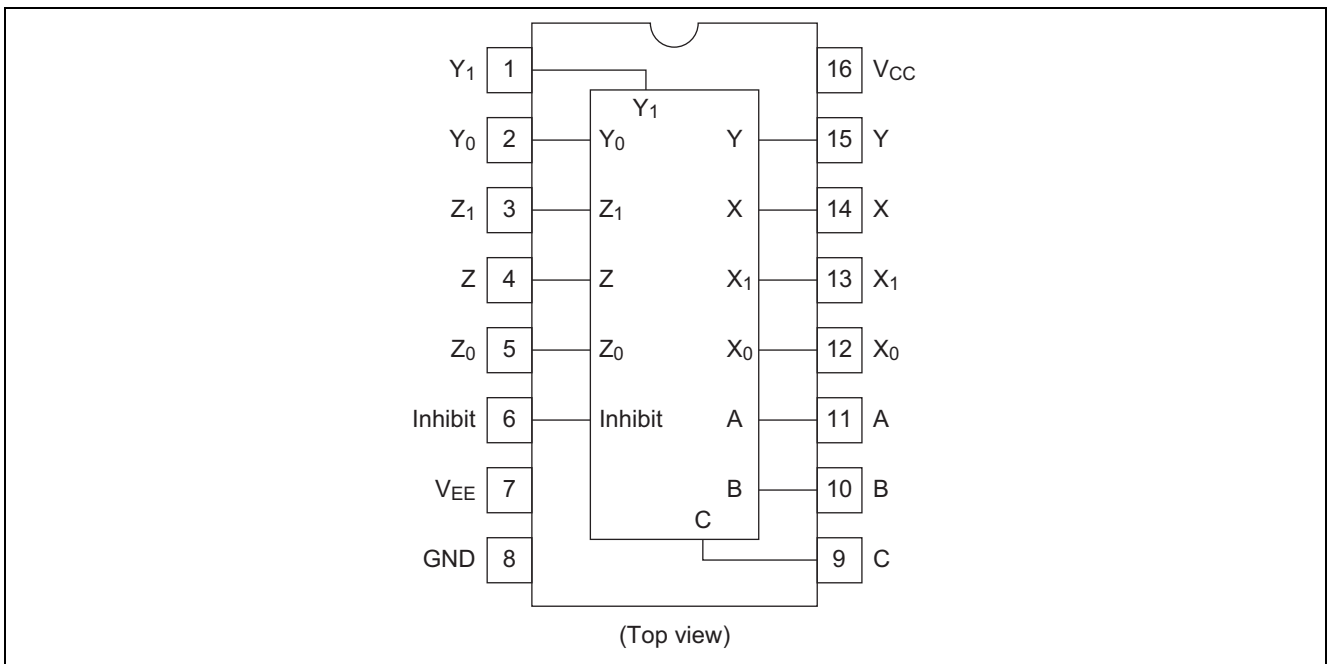
Note: 1. Not applicable for HD74HC4052
X = Irrelevant

Pin Arrangement

HD74HC4052

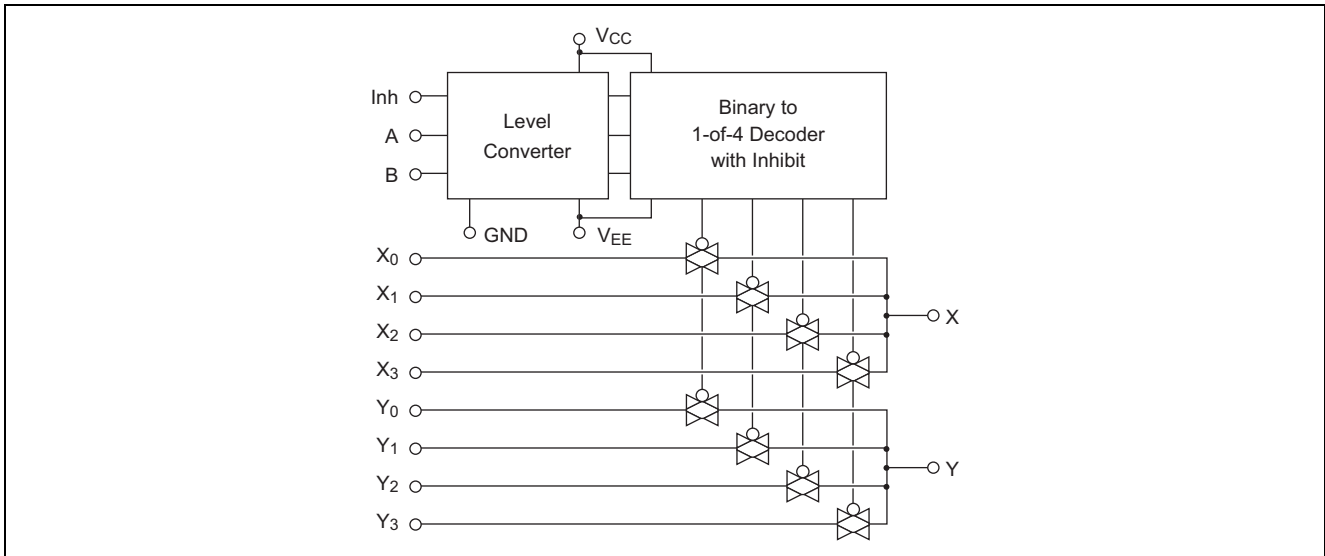


HD74HC4053

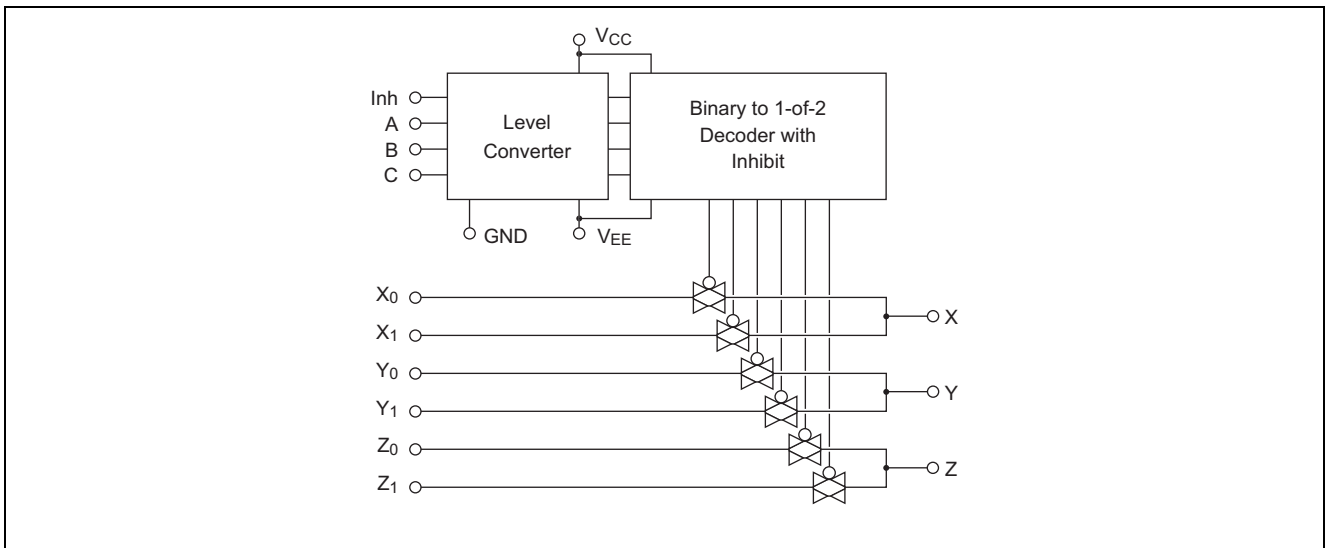


Block Diagram

HD74HC4052



HD74HC4053



Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage	V_{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
	(GND)	I_{GND}	-50
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 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 ($V_{EE} = GND$)

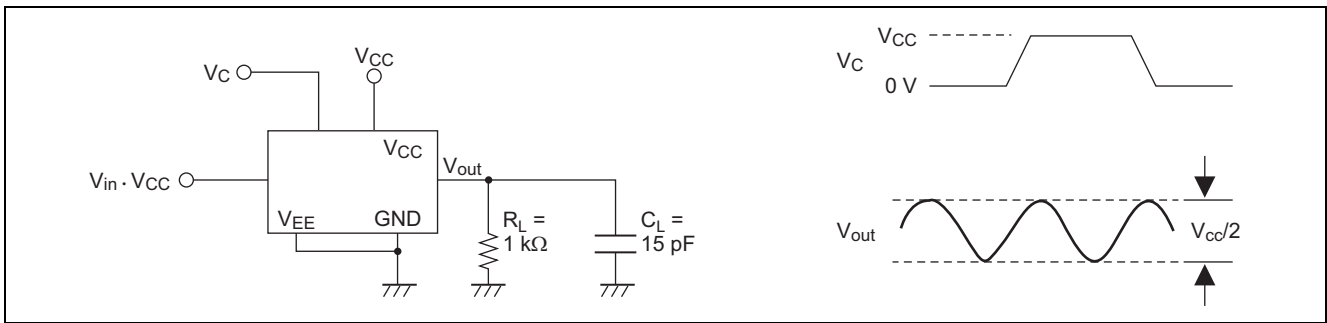
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }+85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Control input voltage	V_{IH}	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	V_{IL}	2.0	—	—	0.5	—	0.5	V		
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
ON resistance	R_{ON}	2.0	—	2000	5000	—	6250	Ω	$V_{INH} = V_{IL}$ $V_{I/O} = V_{CC}$ 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	Ω		
		4.5	—	80	150	—	190			
		6.0	—	70	140	—	175			
Δ ON resistance between any two channels	ΔR_{ON}	2.0	—	50	—	—	—	Ω	$V_{INH} = V_{IL}$ $V_{I/O} = V_{CC}$ 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	—	—	± 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	

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

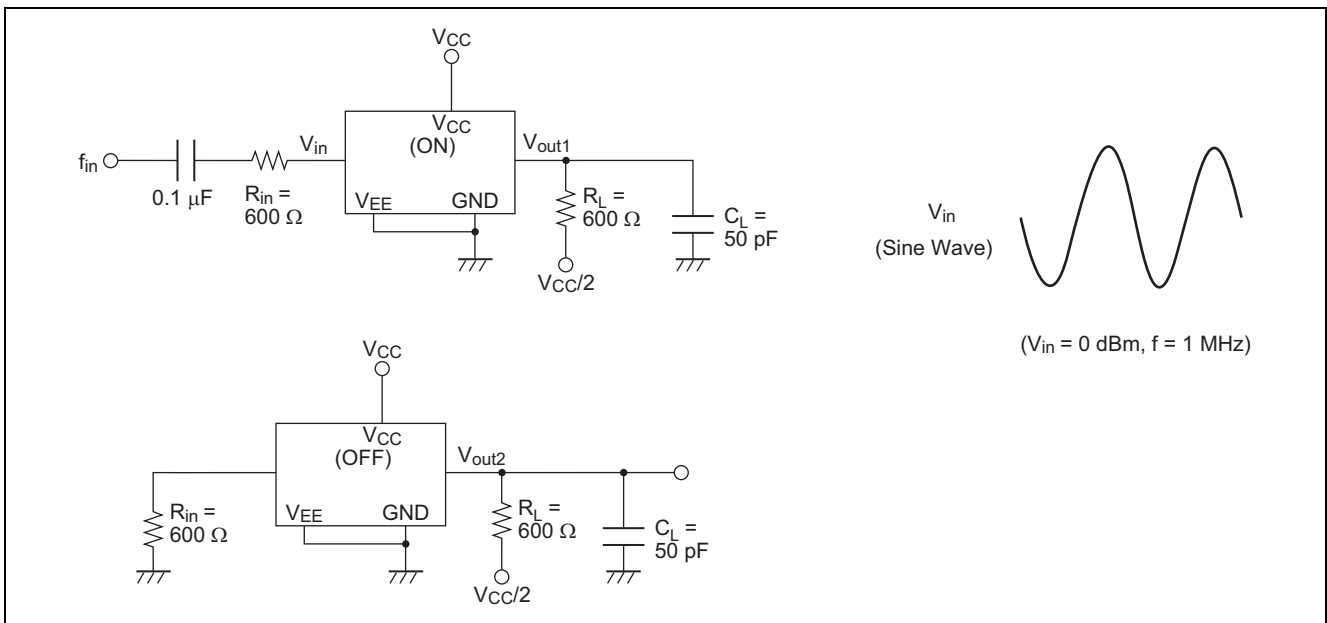
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	t_{PLH}	2.0	—	25	60	—	75	ns	$R_L = 10 \text{ k}\Omega$ Switch input to switch output
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
	t_{PHL}	2.0	—	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

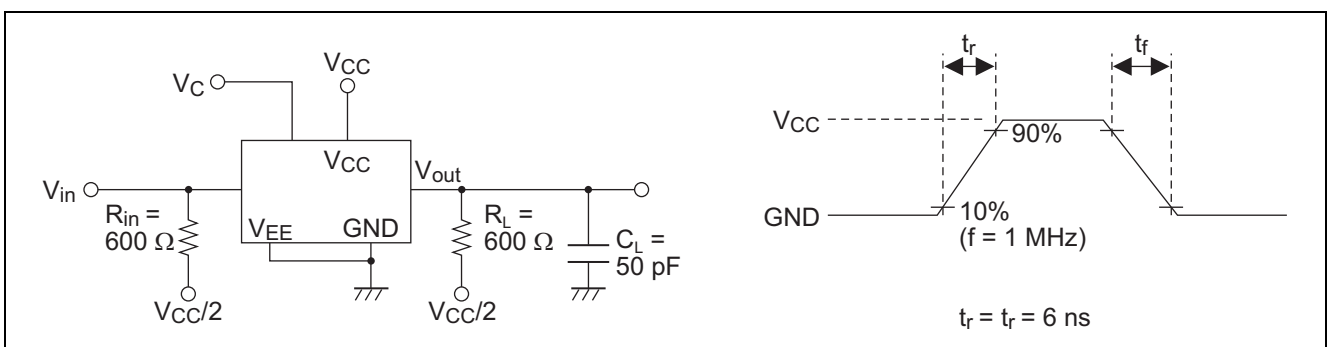
Maximum Control Frequency



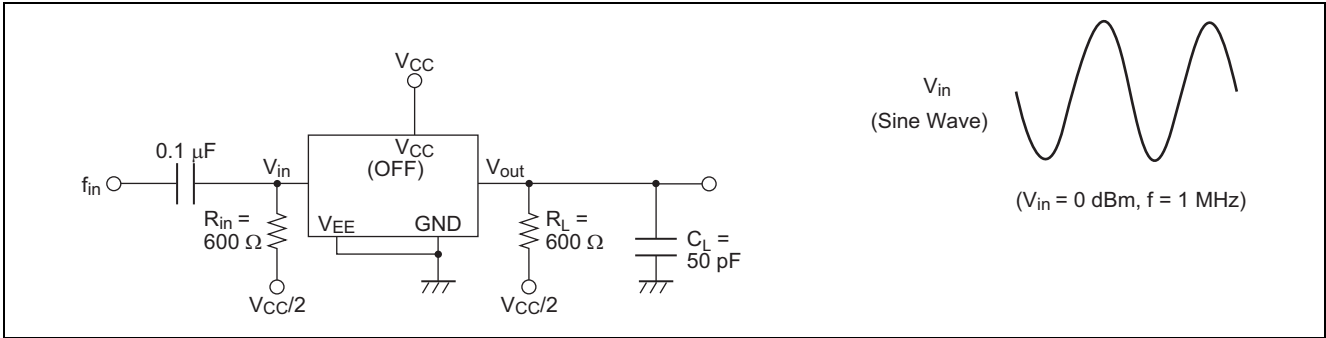
Cross talk (Between Any Two Switches)



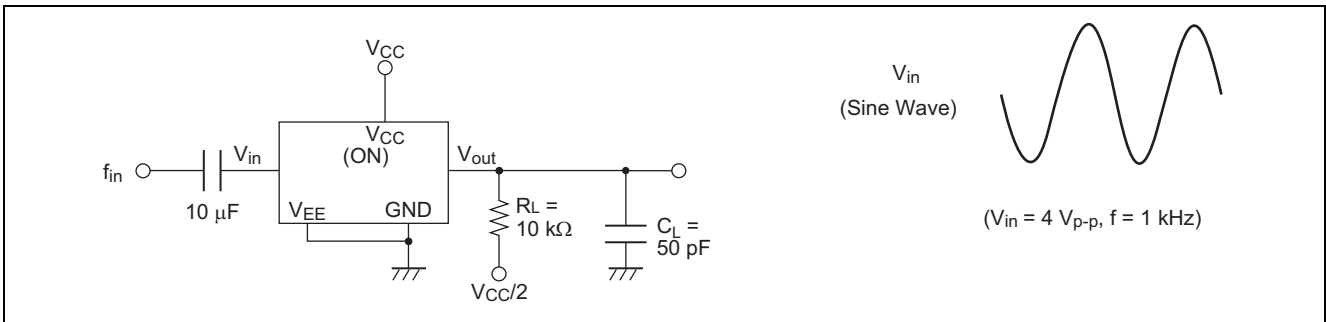
Cross talk (Control Input to Switch Output)



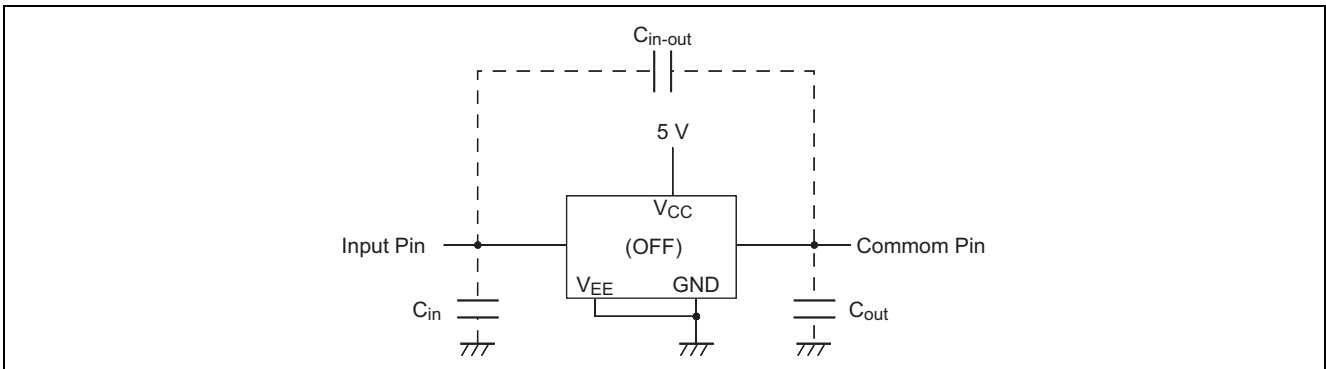
Feed through Attenuation



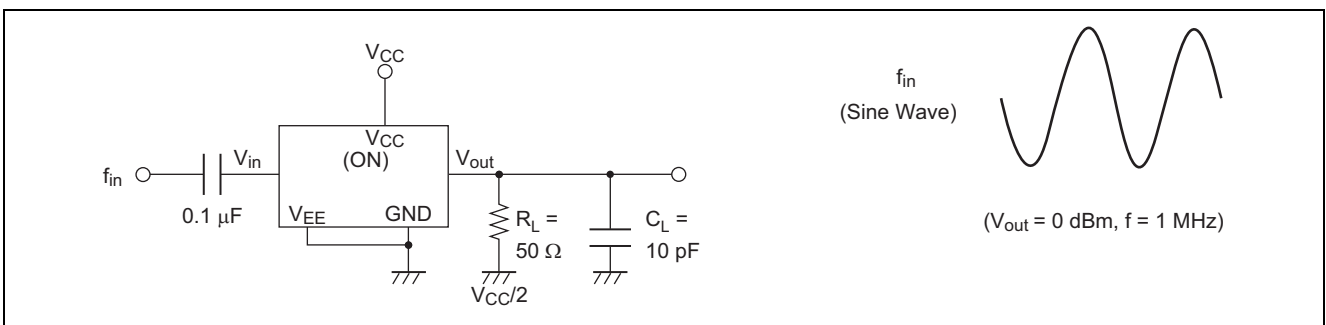
Sine Wave Distortion



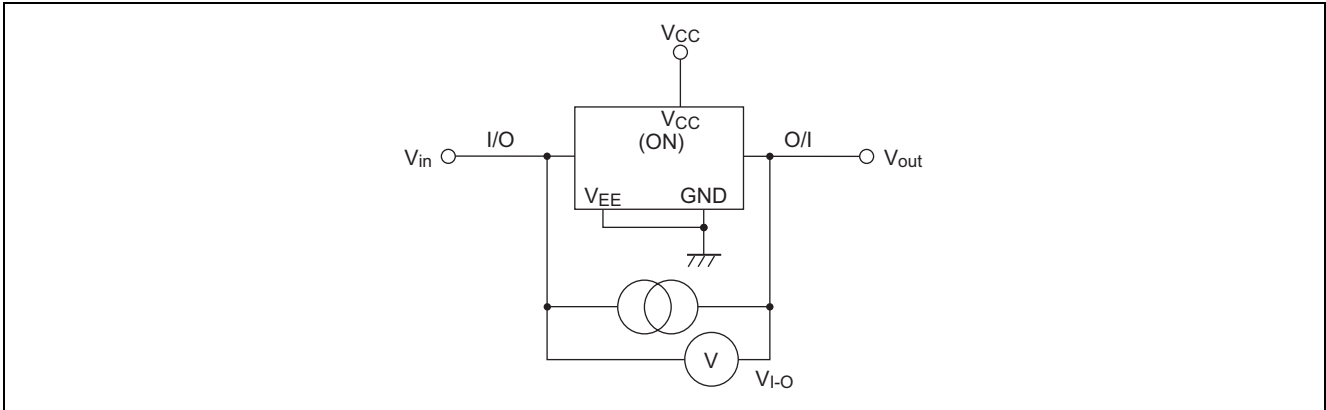
Cin, Cout, Cin-out (Input, Output, and Feed through Capacitance)



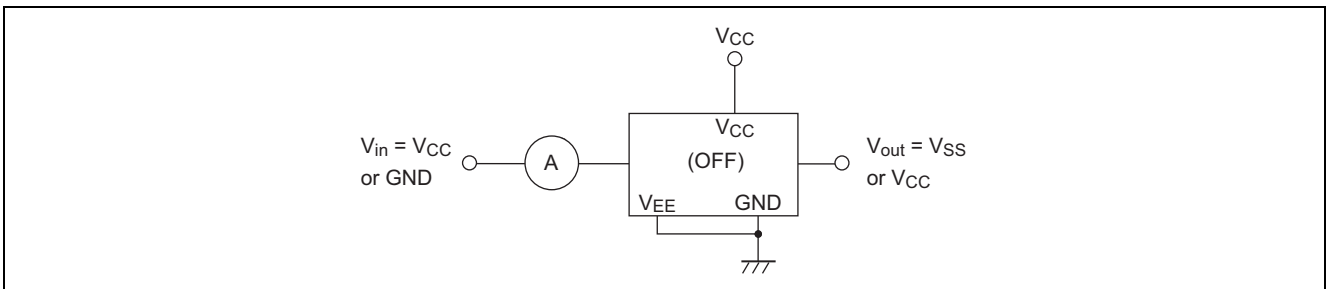
Frequency Response Channel ON



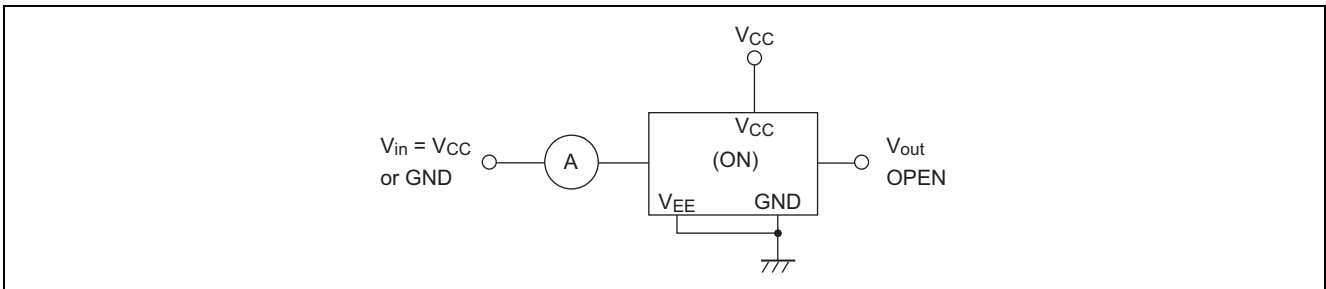
R_{ON}: ON Resistance



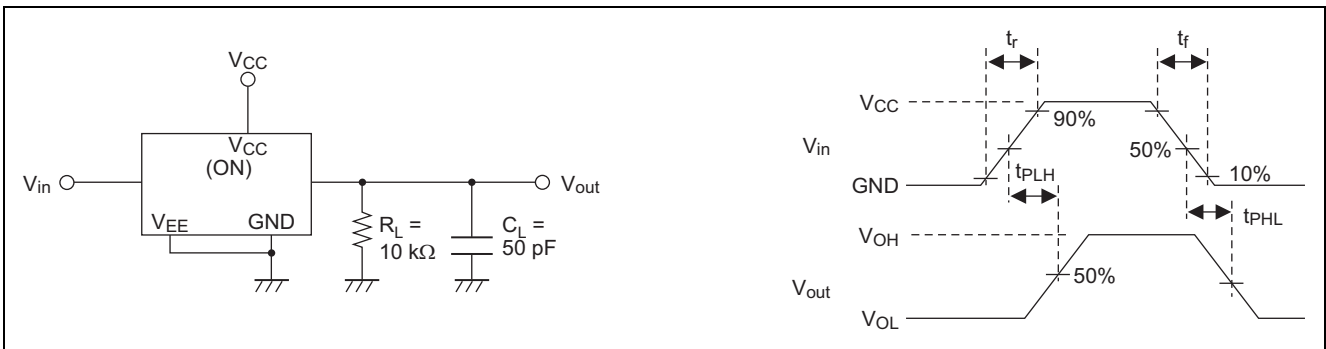
I_s (OFF): OFF Channel Leakage Current (Switch OFF)



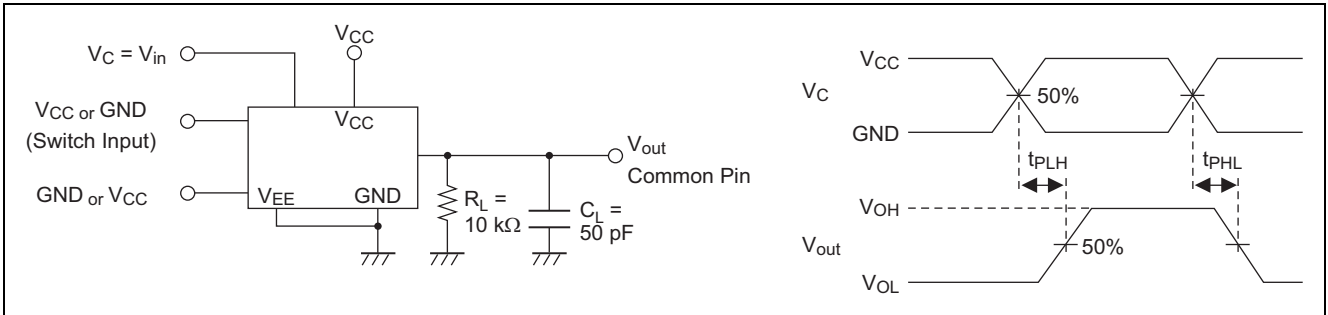
I_s (ON): OFF Channel Leakage Current (Switch ON)



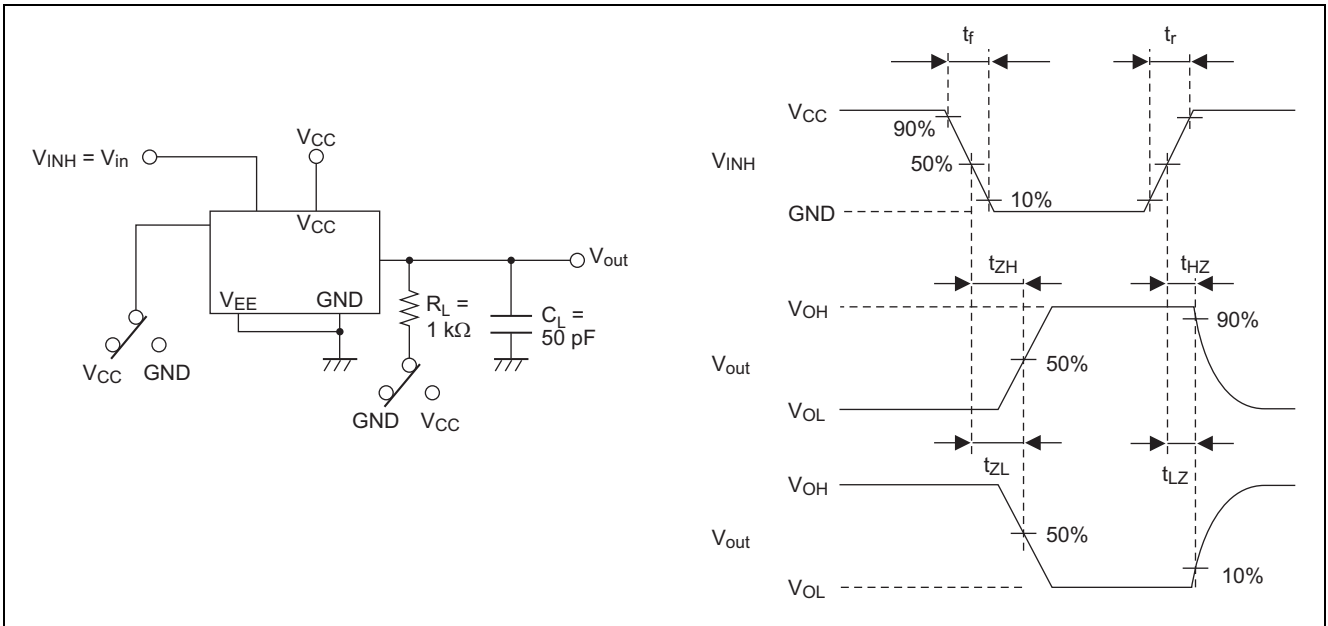
t_{PLH}, t_{PHL}: Propagation Delay Time (Switch Input to Switch Output)



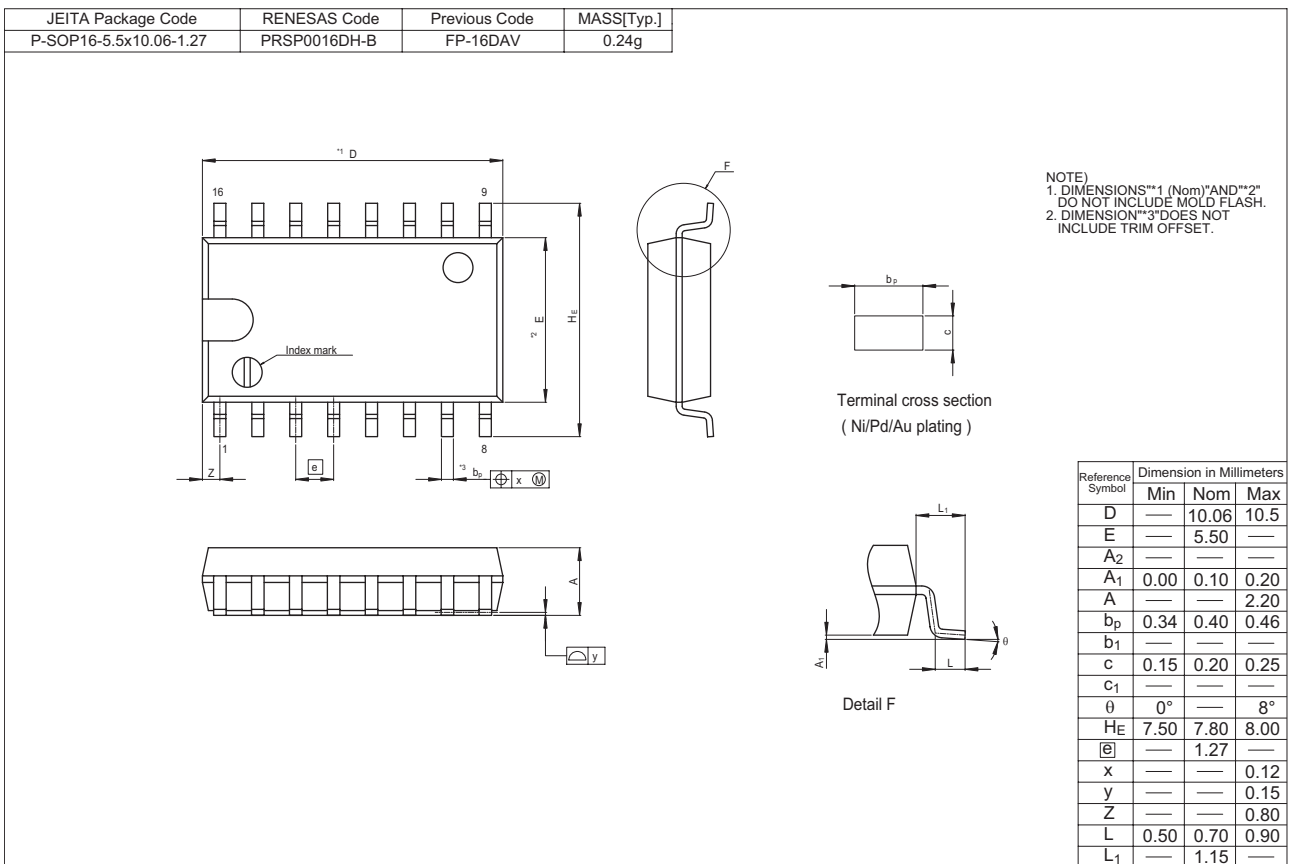
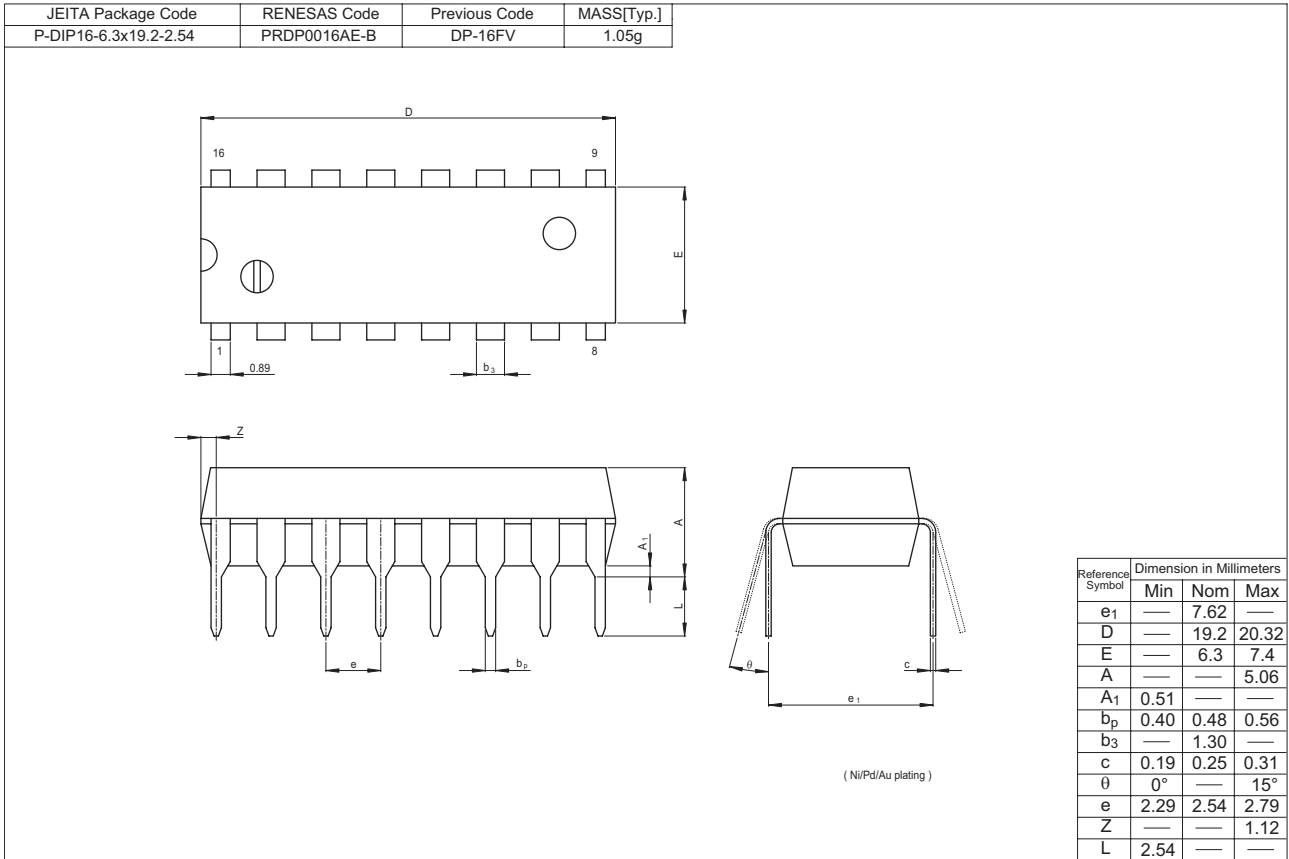
t_{PLH} , t_{PHL} : Propagation Delay Time (Control Input to Switch Output)



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

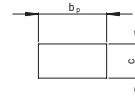
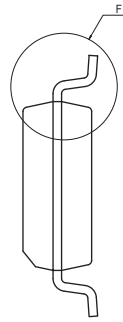
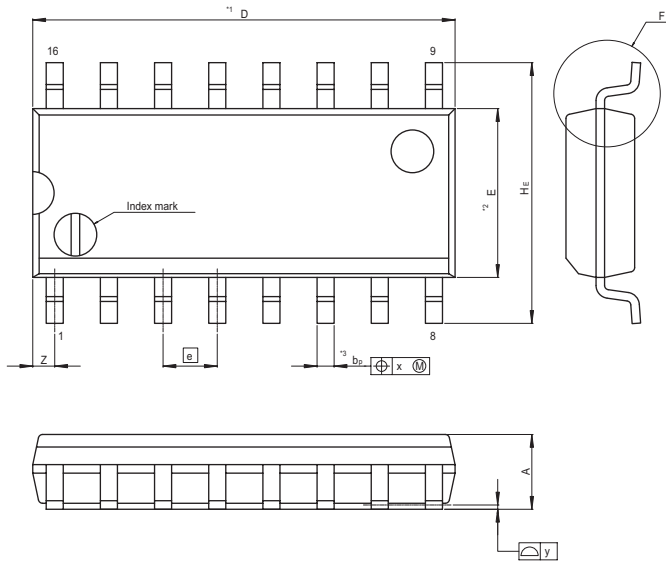


Package Dimensions

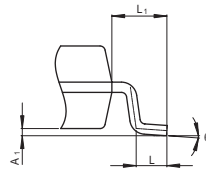


HD74HC4052, HD74HC4053

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 ₂	—	—	—
A ₁	0.10	0.14	0.25
A	—	—	1.75
b _P	0.34	0.40	0.46
b ₁	—	—	—
c	0.15	0.20	0.25
c ₁	—	—	—
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 ₁	—	1.08	—

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