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 µA max (Ta = 25°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.

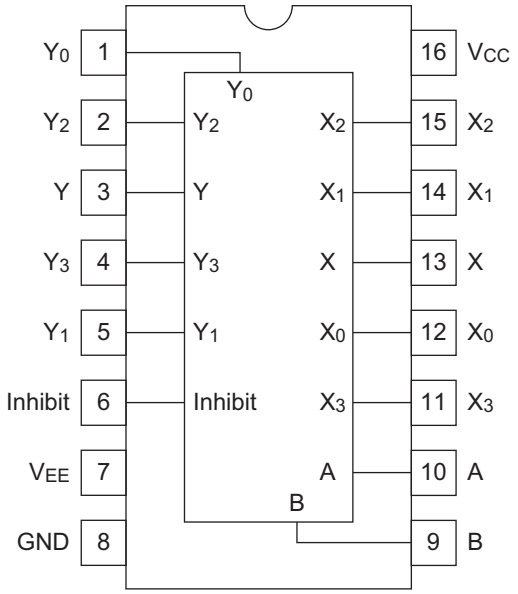
Function Table

Control Inputs				ON Switch				
	Select							
Inhibit	C*[1]	B	A	HD74HC4052		HD74HC4053		
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

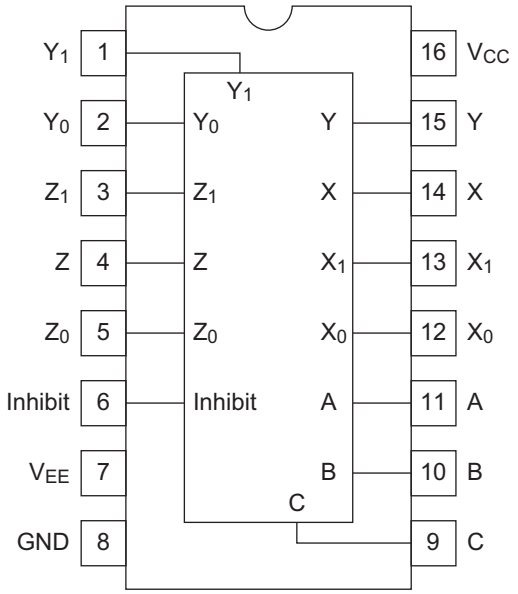
Pin Arrangement

HD74HC4052



(Top view)

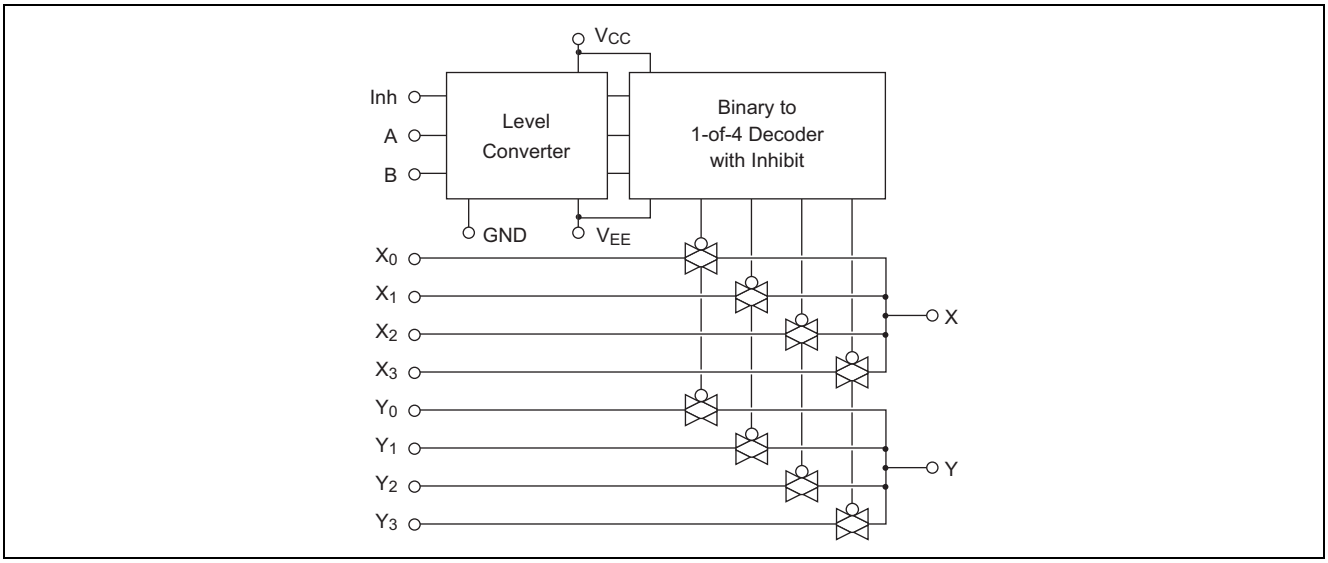
HD74HC4053



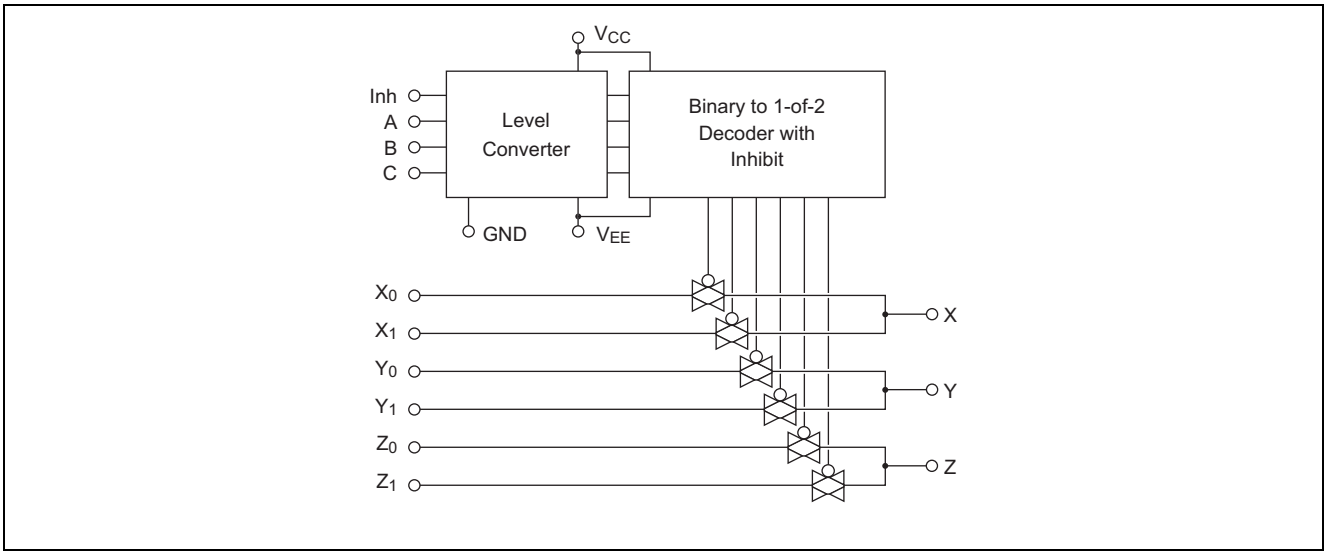
(Top view)

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	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 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		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

Electrical Characteristics (V_{EE} = GND)

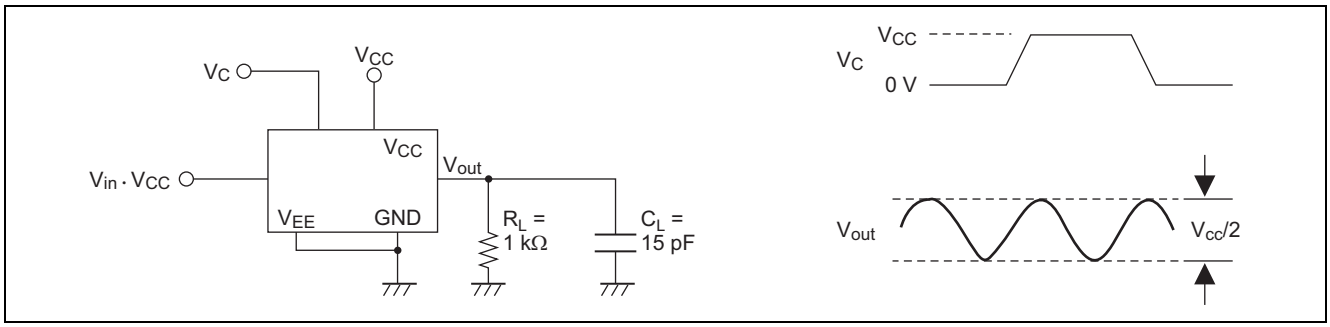
Item	Symbol	V_{CC} (V)	Ta = 25°C			Ta = –40 to+85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Control input voltage	V_{IH}	2.0	1.5	—	—	1.5	—	V	
		4.5	3.15	—	—	3.15	—		
		6.0	4.2	—	—	4.2	—		
	V_{IL}	2.0	—	—	0.5	—	0.5	V	
		4.5	—	—	1.35	—	1.35		
		6.0	—	—	1.8	—	1.8		
ON resistance	R_{ON}	2.0	—	2000	5000	—	6250	Ω	$V_{INH} = V_{IL}$ $V_{I/O} = V_{CC}$ to V_{EE} $I_{I/O} \leq 2$ mA
		4.5	—	120	180	—	225		
		6.0	—	100	170	—	210		
		2.0	—	200	800	—	1000	Ω	$V_{INH} = V_{IL}$ $V_{I/O} = V_{CC}$ or V_{EE} $V_{I/O} \leq 2$ mA
		4.5	—	80	150	—	190		
		6.0	—	70	140	—	175		
ΔON resistance between any two channels	ΔR_{ON}	2.0	—	50	—	—	—	Ω	$V_{INH} = V_{IL}$ $V_{I/O} = V_{CC}$ to V_{EE} $I_{I/O} \leq 2$ 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	Iin	6.0	—	—	±0.1	—	±1.0	μA	Vin = V_{CC} or GND
Quiescent supply current	I_{CC}	6.0	—	—	4.0	—	40	μA	Vin = V_{CC} or GND

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

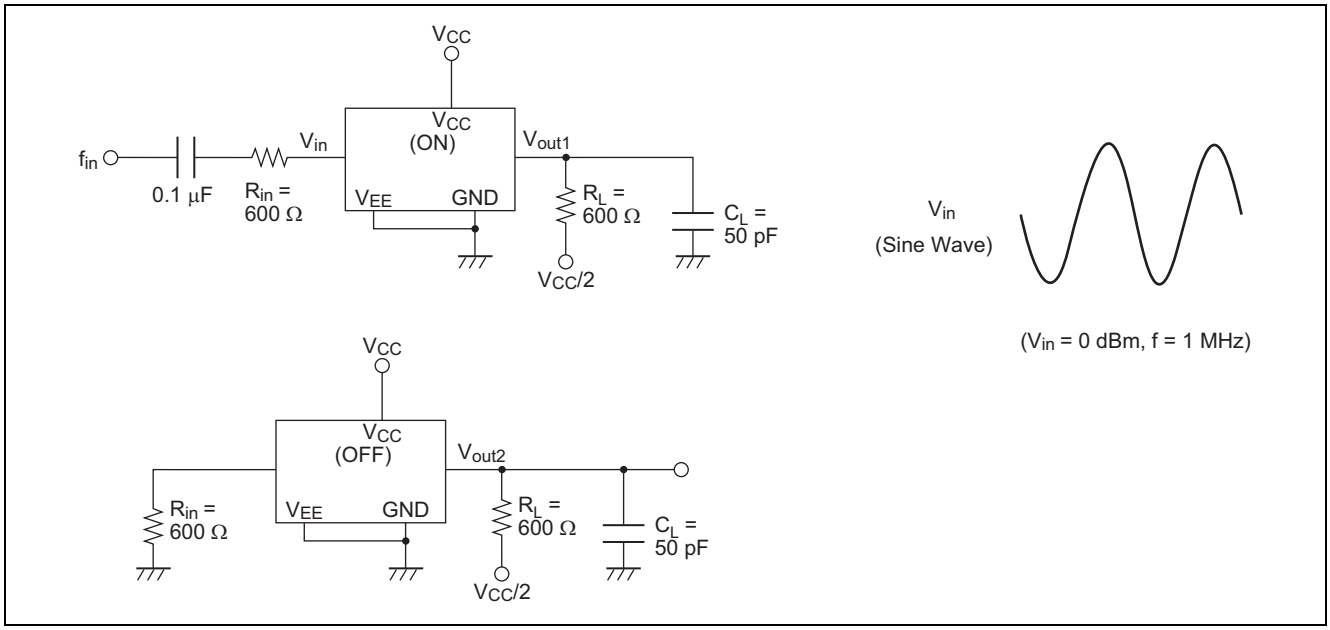
Item	Symbol	V_{CC} (V)	Ta = 25°C			Ta = –40 to +85°C		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	t_{PLH}	2.0	—	25	60	—	75	ns	R_L = 10 kΩ Switch input to switch output
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
	t_{PHL}	2.0	—	25	60	—	75	ns	
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
Propagation delay time	t_{PLH}	2.0	—	50	153	—	191	ns	R_L = 10 kΩ 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 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	Cin	—	—	5	10	—	10	pF	
Switch input capacitance	Cin	5.0	—	5	—	—	—	pF	
Output capacitance (Common pin)	Cout	5.0	—	12	—	—	—	pF	HD74HC4052
		5.0	—	6	—	—	—		HD74HC4053
Feed through capacitance	Cin–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 kHz, Vin = 4 V_{P-P} R_L = 10 kΩ, C_L = 50 pF
Frequency response channel “ON” (Sine wave input)		4.5	—	95	—	—	—	MHz	f_{in} = 1 MHz, 20 $\log_{10}$ V_{OS}/V_{IS} = –3 dB R_L = 50 Ω, C_L = 10 pF
Feed through attenuation		4.5	—	–50	—	—	—	dB	R_L = 600 Ω, C_L = 50 pF, f_{in} = 1 MHz
Cross talk between control input and switch I/O		2.0	—	25	—	—	—	mV	R_L = 600 Ω, C_L = 15 pF, f_{in} = 1 MHz
		4.5	—	50	—	—	—		
		6.0	—	75	—	—	—		
Cross talk between any two switches		4.5	—	–50	—	—	—	dB	R_L = 600 Ω, C_L = 50 pF, f_{in} = 1 MHz
Maximum control frequency		2.0	—	20	—	—	—	MHz	R_L = 1 kΩ, C_L = 15 pF Vout = 1/2 (V_{CC})
		4.5	—	30	—	—	—		
		6.0	—	30	—	—	—		

Test Circuit

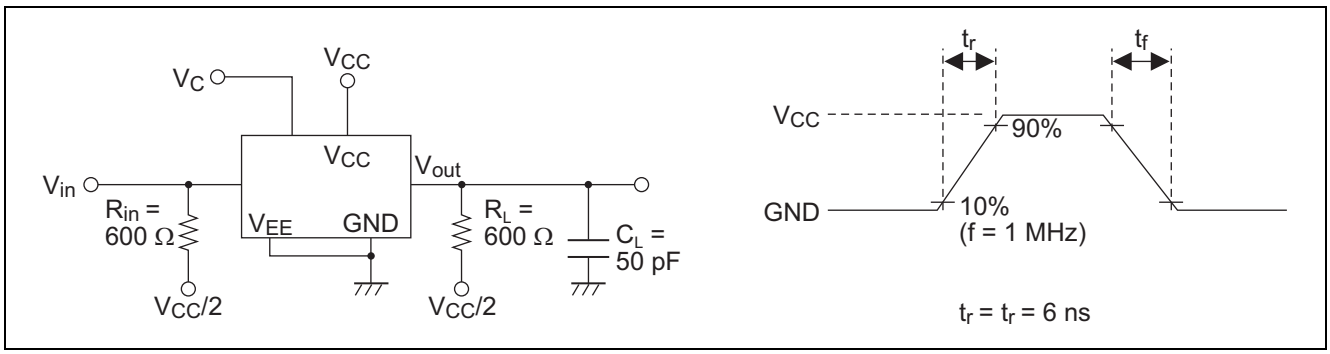
Maximum Control Frequency



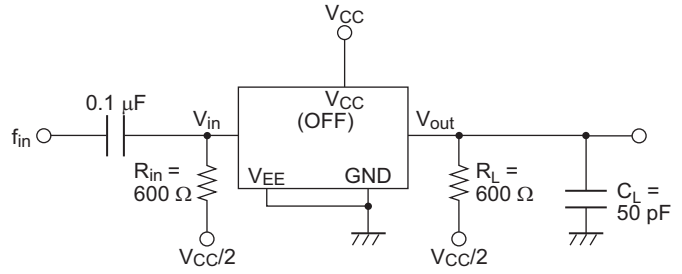
Cross talk (Between Any Two Switches)

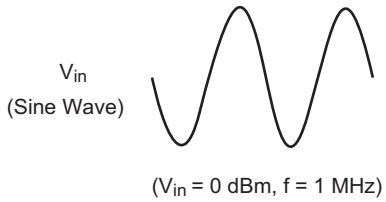


Cross talk (Control Input to Switch Output)



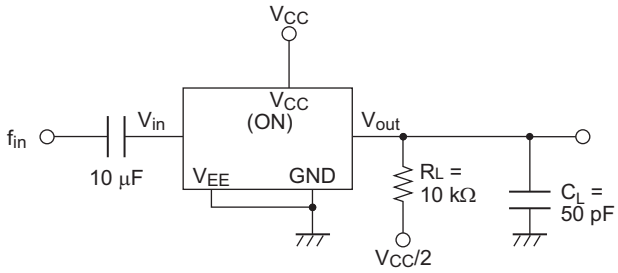
Feed through Attenuation

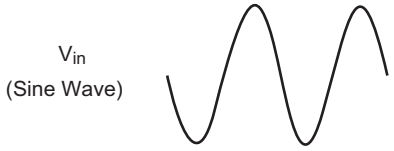




(Vin = 0 dBm, f = 1 MHz)

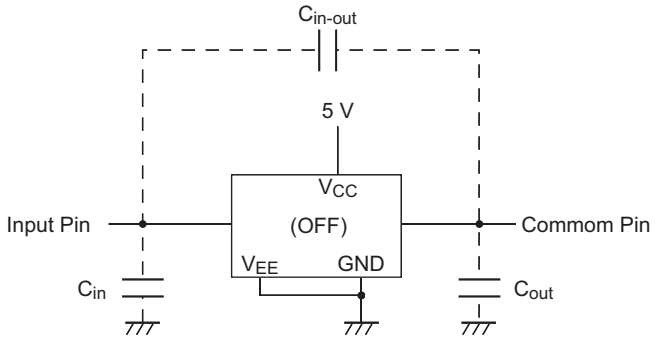
Sine Wave Distortion



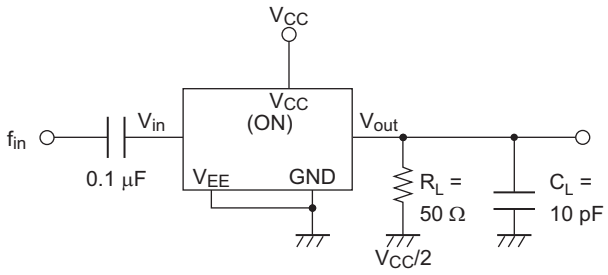


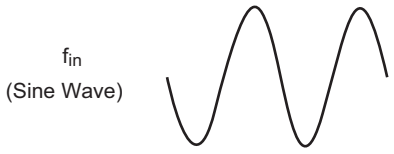
(Vin = 4 Vp-p, f = 1 kHz)

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



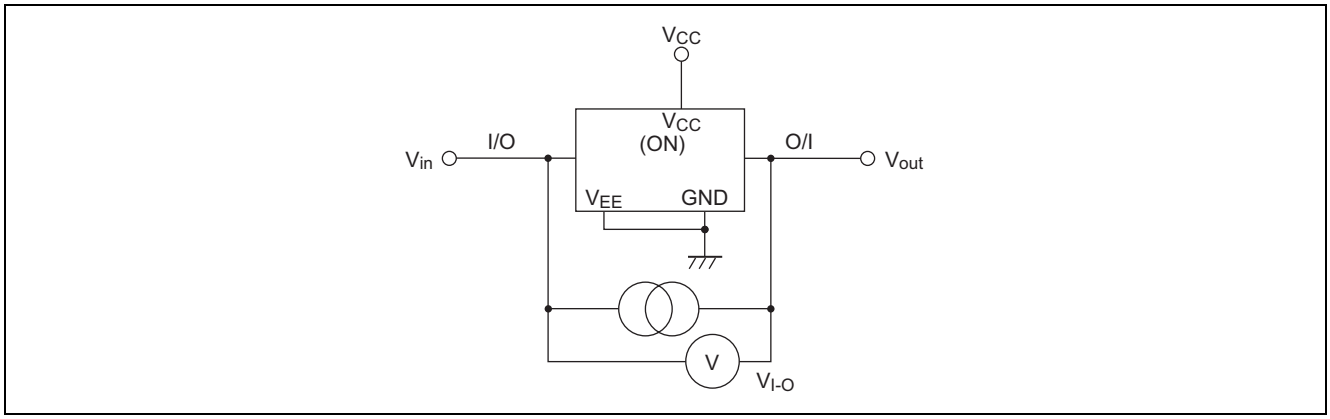
Frequency Response Channel ON



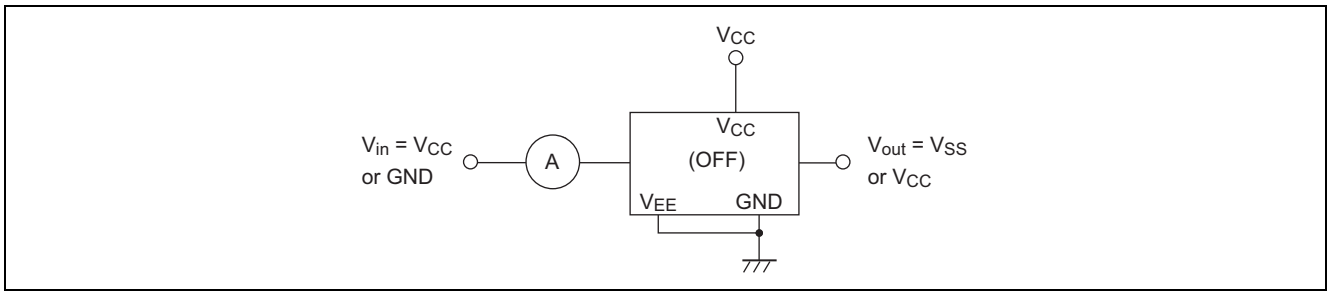


(Vout = 0 dBm, f = 1 MHz)

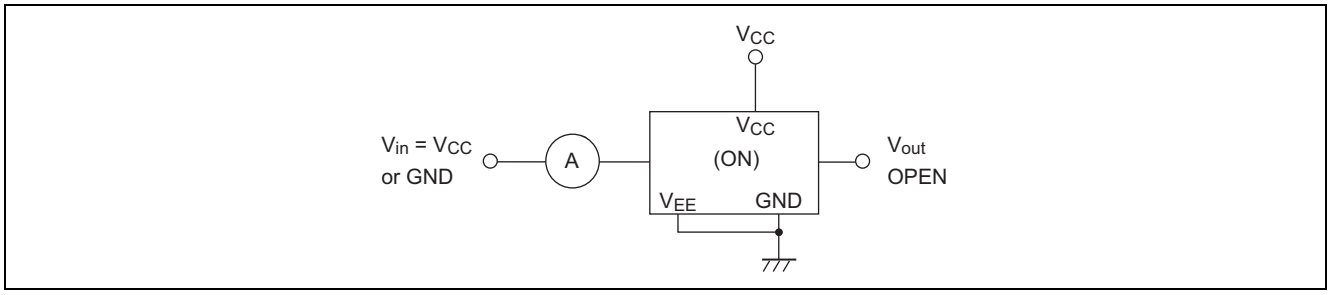
R_{ON}: ON Resistance



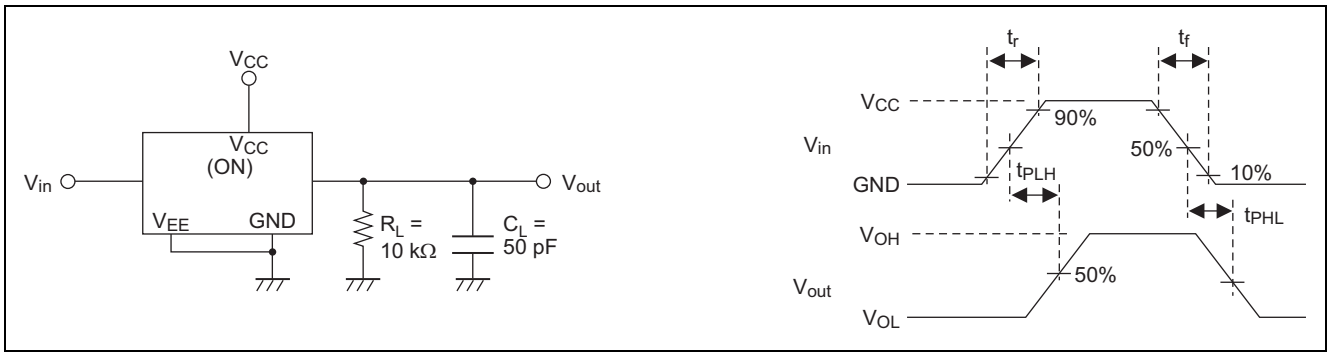
I_S (OFF): OFF Channel Leakage Current (Switch OFF)



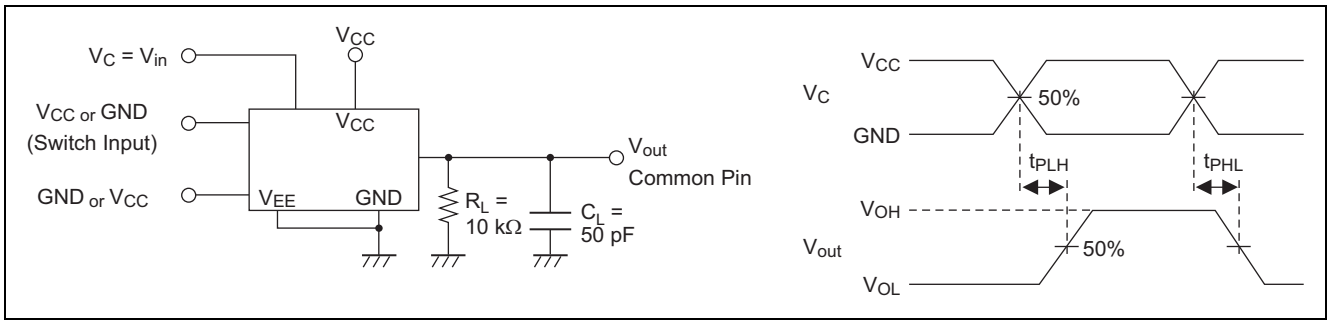
I_S (ON): OFF Channel Leakage Current (Switch ON)



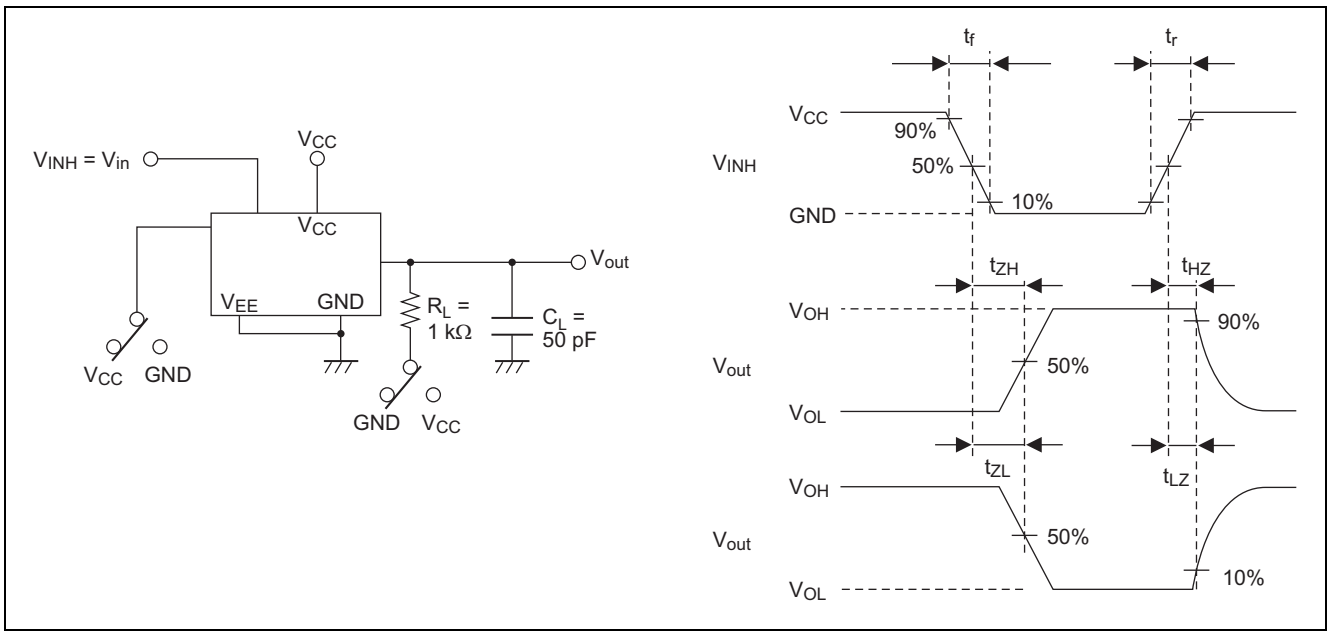
t_{PLH}, t_{PHL}: Propagation Delay Time (Switch Input to Switch Output)



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

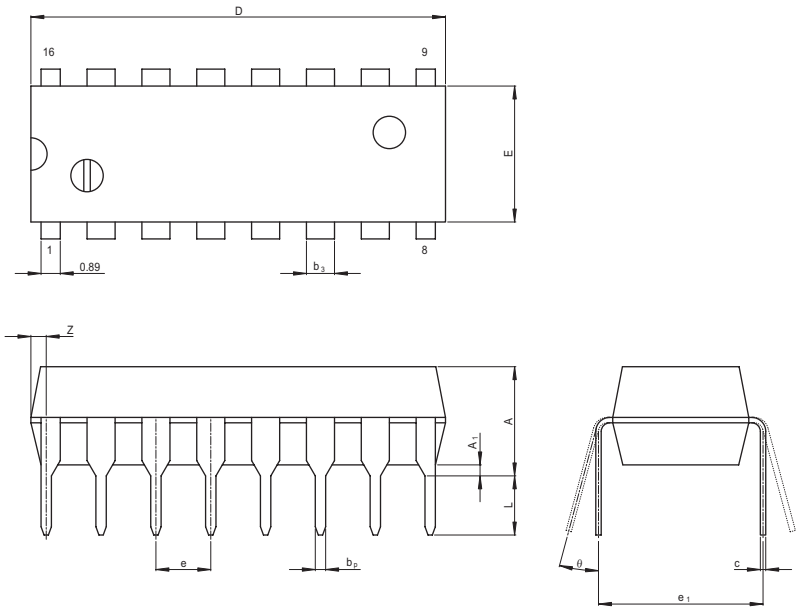


t_{ZH}, t_{ZL}/t_{HZ}, t_{LZ}: Output Enable and Disable Time



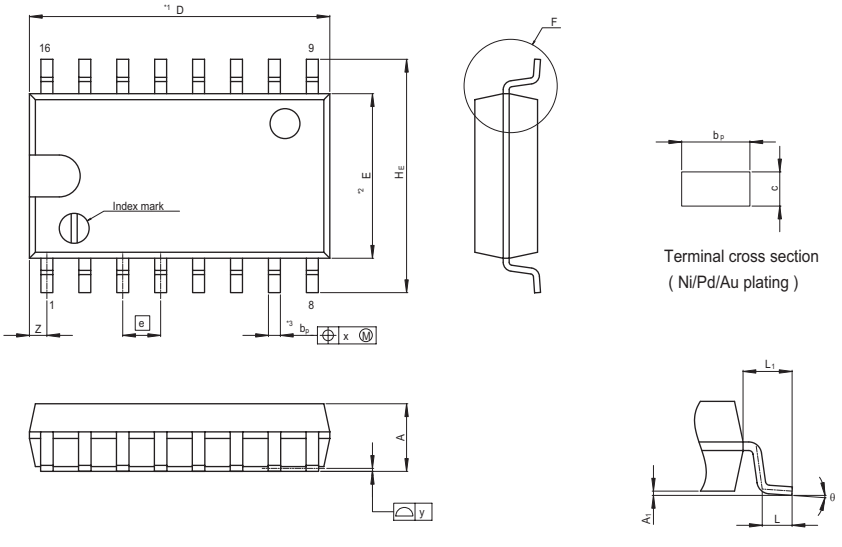
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19.2-2.54	PRDP0016AE-B	DP-16FV	1.05g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e_1	—	7.62	—
D	—	19.2	20.32
E	—	6.3	7.4
A	—	—	5.06
A_1	0.51	—	—
b_p	0.40	0.48	0.56
b_3	—	1.30	—
c	0.19	0.25	0.31
θ	0°	—	15°
e	2.29	2.54	2.79
Z	—	—	1.12
L	2.54	—	—

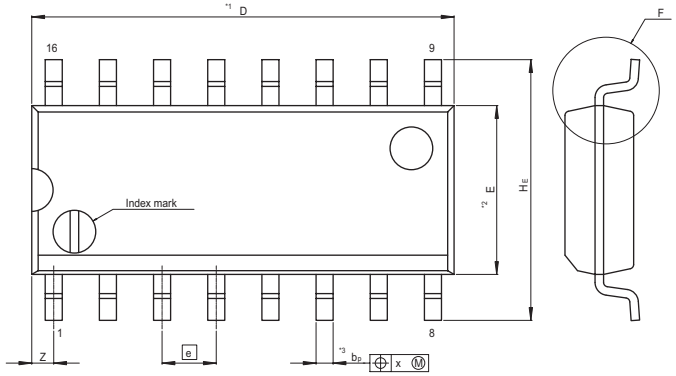
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.5x10.06-1.27	PRSP0016DH-B	FP-16DAV	0.24g

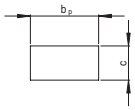


NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

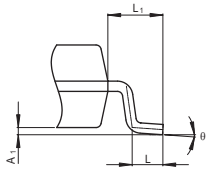
Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	10.06	10.5
E	—	5.50	—
A_2	—	—	—
A_1	0.00	0.10	0.20
A	—	—	2.20
b_p	0.34	0.40	0.46
b_1	—	—	—
c	0.15	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	7.50	7.80	8.00
e	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.80
L	0.50	0.70	0.90
L_1	—	1.15	—

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°
H_E	5.80	6.10	6.20
e	—	1.27	—
x	—	—	0.25
y	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L_1	—	1.08	—