

# HD74HC4051

## 8-Channel Analog Multiplexer Demultiplexer

REJ03D0648-0200  
 (Previous ADE-205-535)  
 Rev.2.00  
 Mar 30, 2006

### 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:  $V_{CC} = 2$  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)
HD74HC4051P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74HC4051FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)
HD74HC4051RPEL	SOP-16 pin (JEDEC)	PRSP0016DG-A (FP-16DNV)	RP	EL (2,500 pcs/reel)

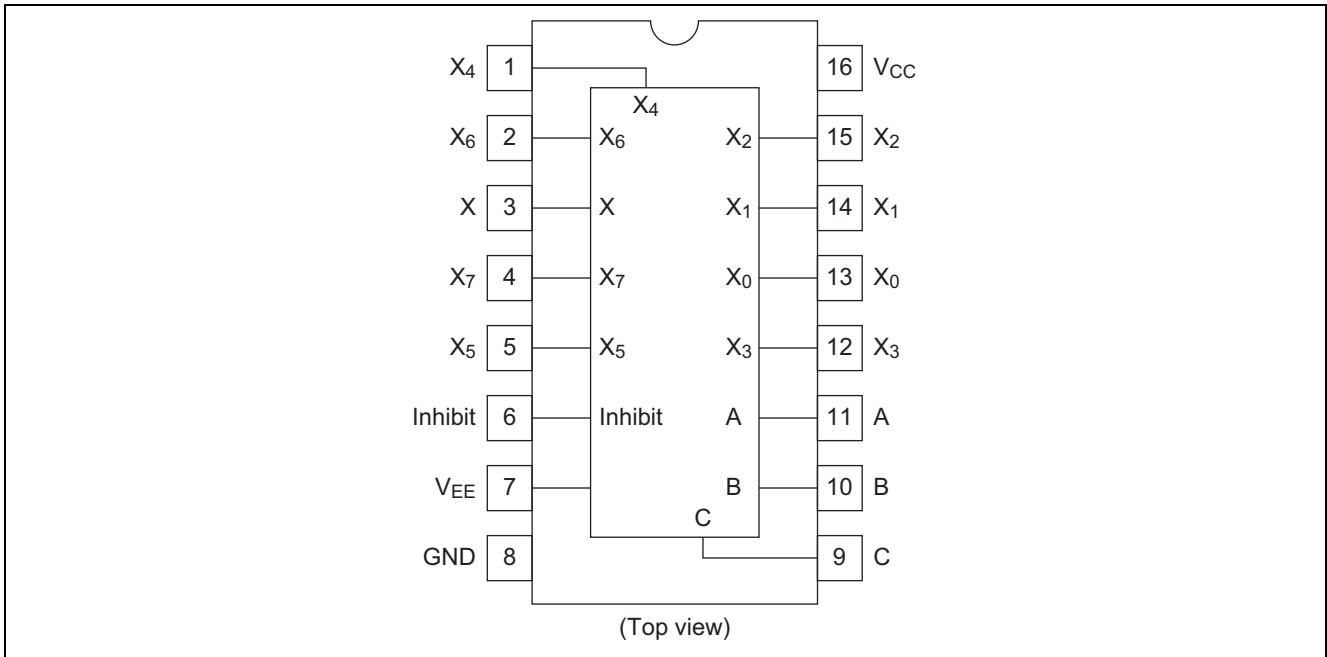
Note: Please consult the sales office for the above package availability.

### Function Table

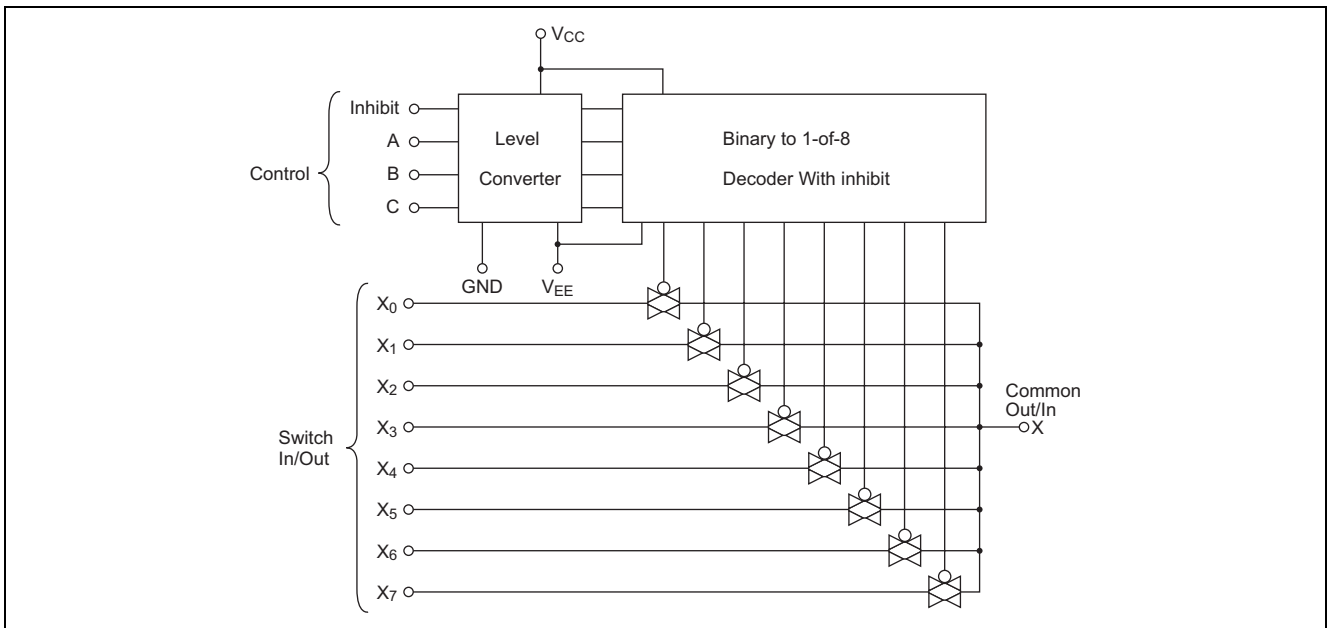
Control Inputs				ON Switch
Inhibit	C	B	A	
L	L	L	L	$X_0$
L	L	L	H	$X_1$
L	L	H	L	$X_2$
L	L	H	H	$X_3$
L	H	L	L	$X_4$
L	H	L	H	$X_5$
L	H	H	L	$X_6$
L	H	H	H	$X_7$
H	X	X	X	—

X: Irrelevant

## 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 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	$V_{CC} = 2.0$ 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

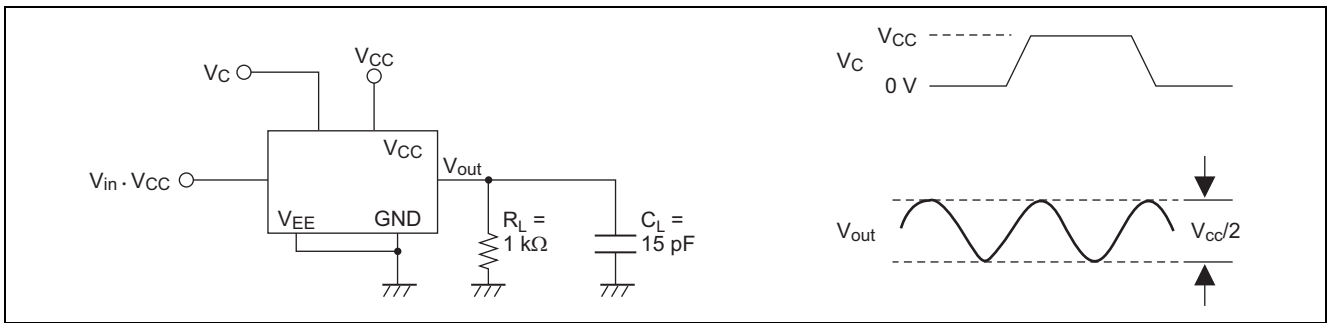
Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to+85°C		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Control input voltage	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5	V		
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
ON resistance	R <sub>ON</sub>	2.0	—	2000	5000	—	6250	Ω	V <sub>INH</sub> = V <sub>IL</sub> V <sub>I/O</sub> = V <sub>CC</sub> to V <sub>EE</sub> I <sub>I/O</sub> ≤ 2 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			
ΔON resistance between any two channels	ΔR <sub>ON</sub>	2.0	—	50	—	—	—	Ω	V <sub>INH</sub> = V <sub>IL</sub> V <sub>I/O</sub> = V <sub>CC</sub> to V <sub>EE</sub> I <sub>I/O</sub> ≤ 2 mA	
		4.5	—	13	40	—	50			
		6.0	—	10	20	—	25			
OFF channel leakage current (switch off)	I <sub>S(OFF)</sub>	6.0	—	—	±0.1	—	±1.0	μA		V <sub>INH</sub> = V <sub>IL</sub>
OFF channel leakage current (switch on)	I <sub>S(ON)</sub>	6.0	—	—	±0.1	—	±1.0	μA		V <sub>INH</sub> = V <sub>IL</sub>
Control input current	I <sub>in</sub>	6.0	—	—	±0.1	—	±1.0	μA		V <sub>in</sub> = V <sub>CC</sub> or GND
Quiescent supply current	I <sub>CC</sub>	6.0	—	—	4.0	—	40	μA	V <sub>in</sub> = V <sub>CC</sub> or GND	

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

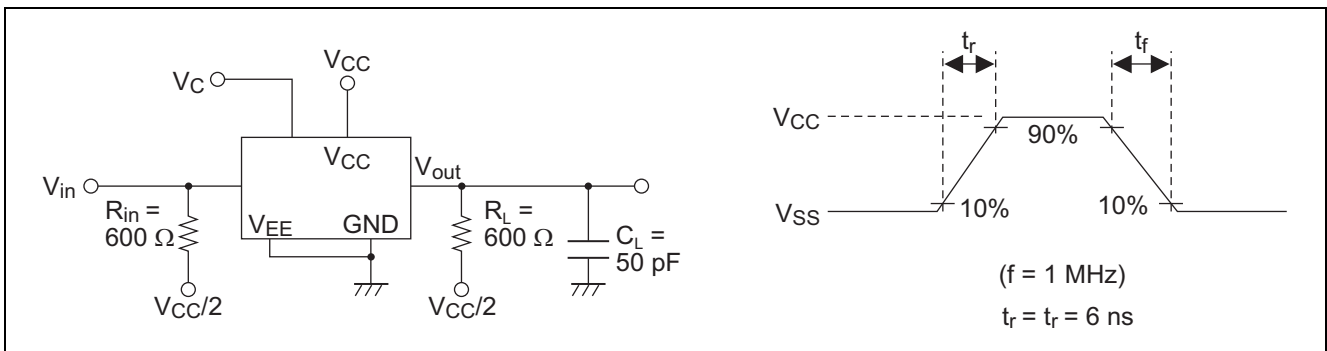
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	$t_{PLH}$	2.0	—	25	60	—	75	ns	$R_L = 10 \text{ k}\Omega$ Switch input to switch output
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
	$t_{PHL}$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

## Test Circuit

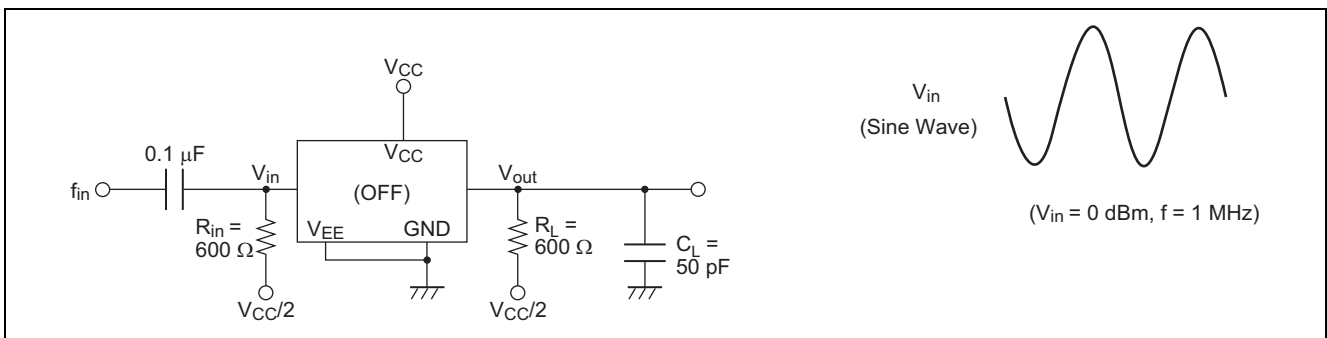
### Maximum Control Frequency



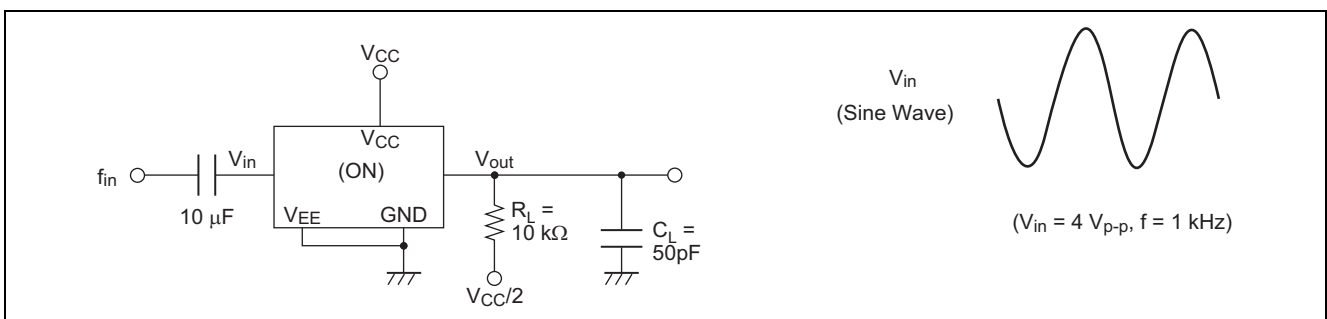
### Cross talk (Control Input to Switch Output)



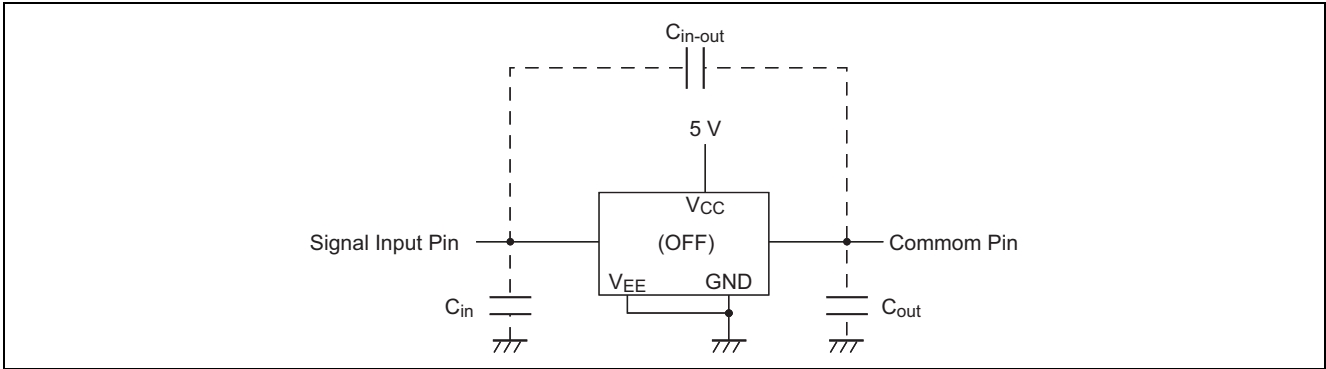
### Feed through Attenuation



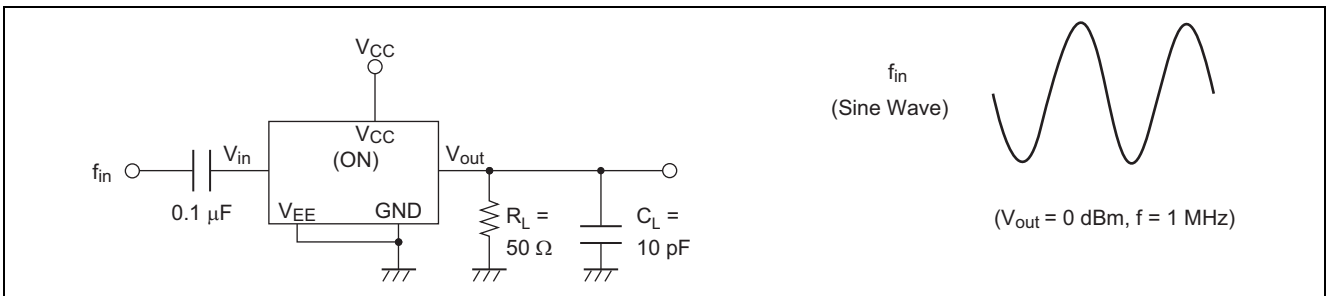
### Sine Wave Distortion



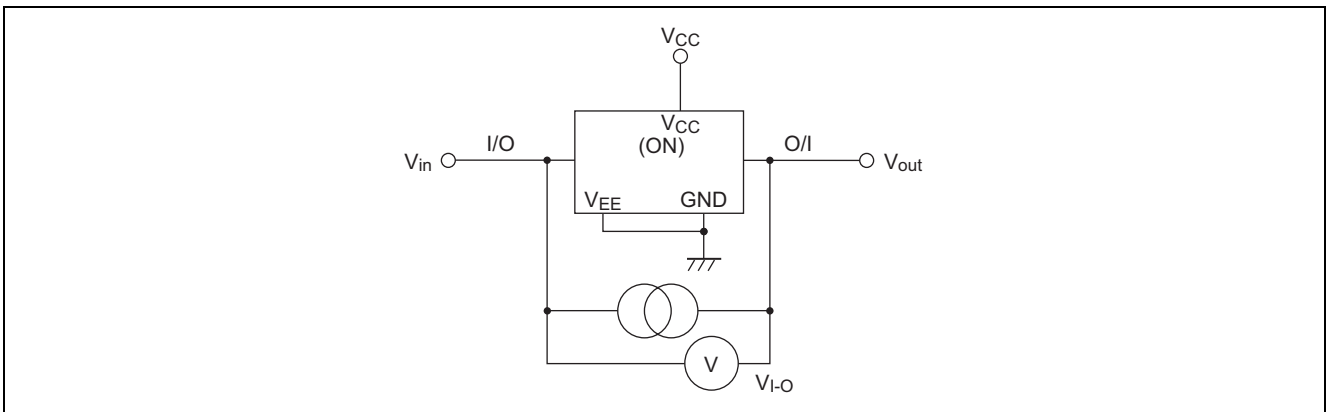
**C<sub>in</sub>, C<sub>out</sub>, C<sub>in-out</sub> (Input, Output, and Feed through Capacitance)**



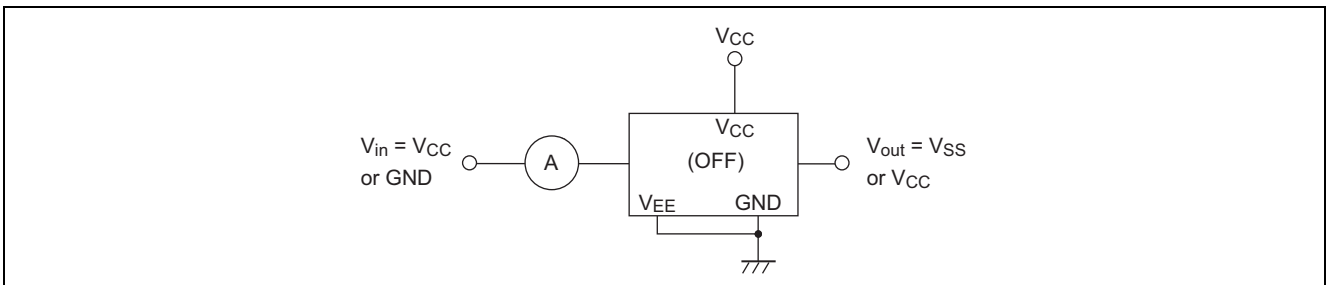
**Frequency Response Channel ON**



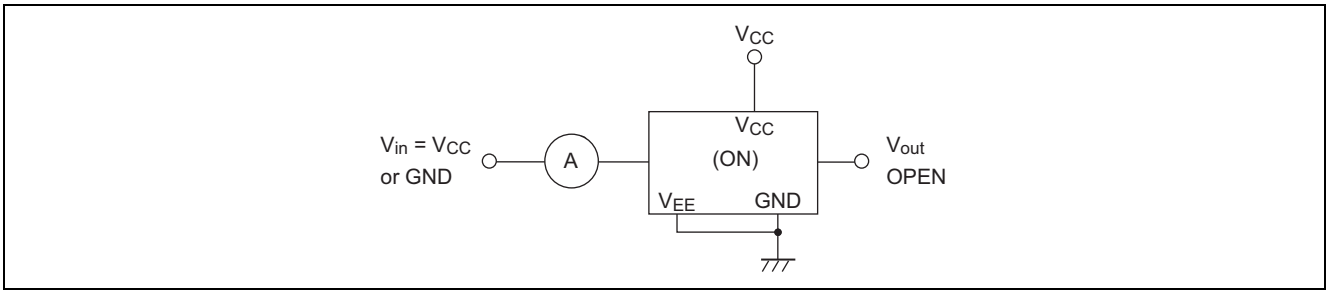
**R<sub>ON</sub>: ON Resistance**



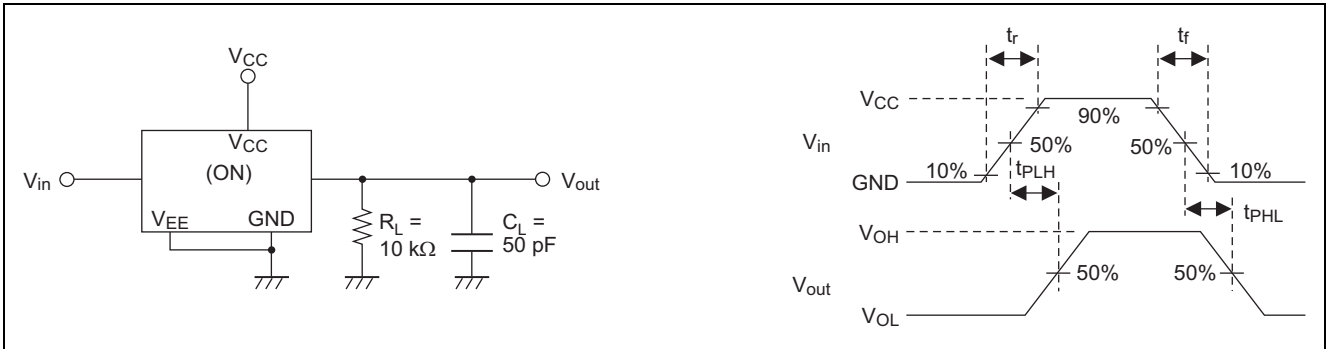
**I<sub>s</sub> (OFF): OFF Channel Leakage Current (Switch OFF)**



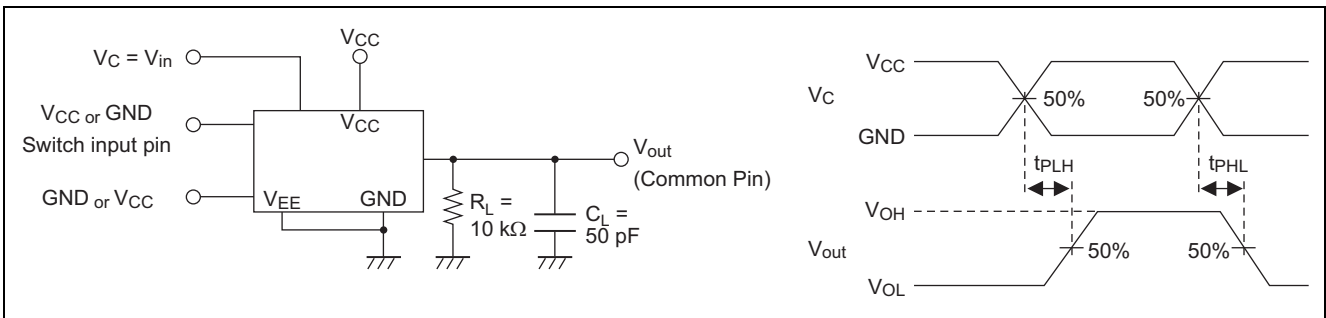
**$I_s$  (ON): OFF Channel Leakage Current (Switch ON)**



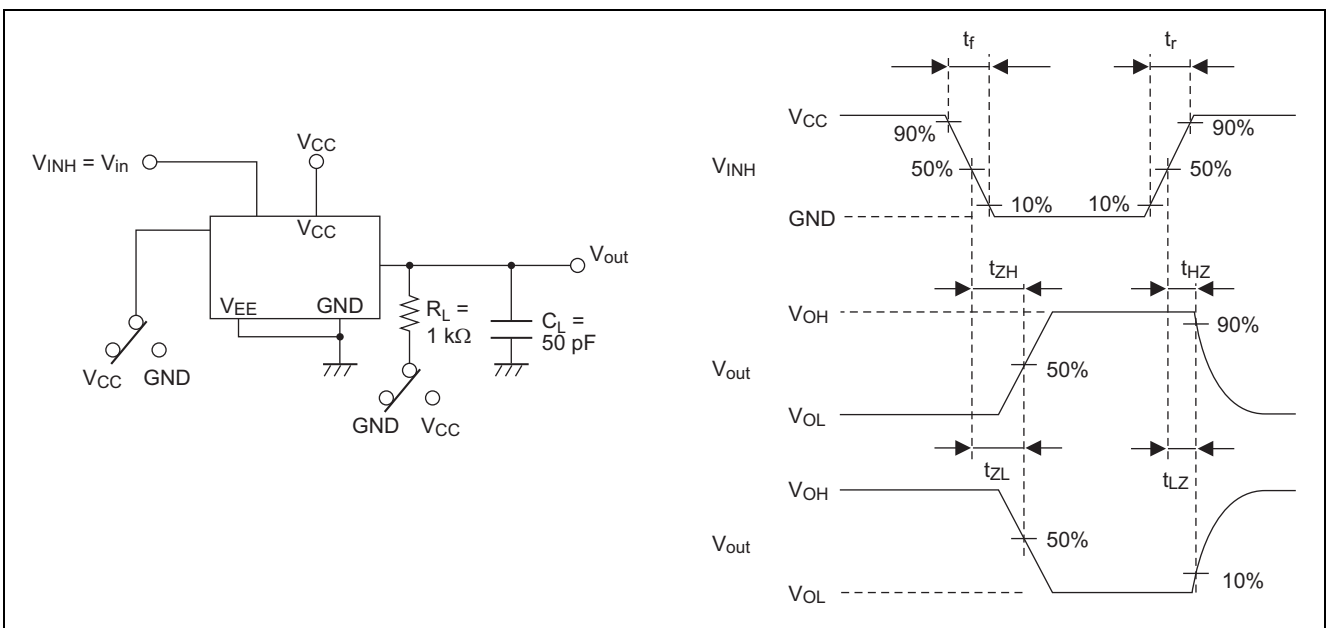
**$t_{PLH}$ ,  $t_{PHL}$ : Propagation Delay Time (Switch Input to Switch Output)**



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



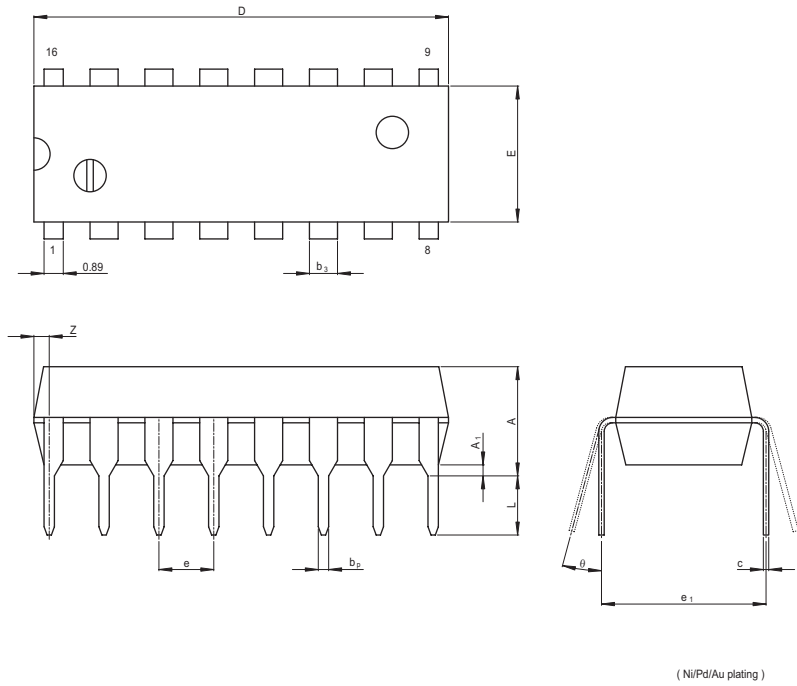
**$t_{ZH}$ ,  $t_{ZL}/t_{HZ}$ ,  $t_{LZ}$ : Output Enable and Disable Time**





Package Dimensions

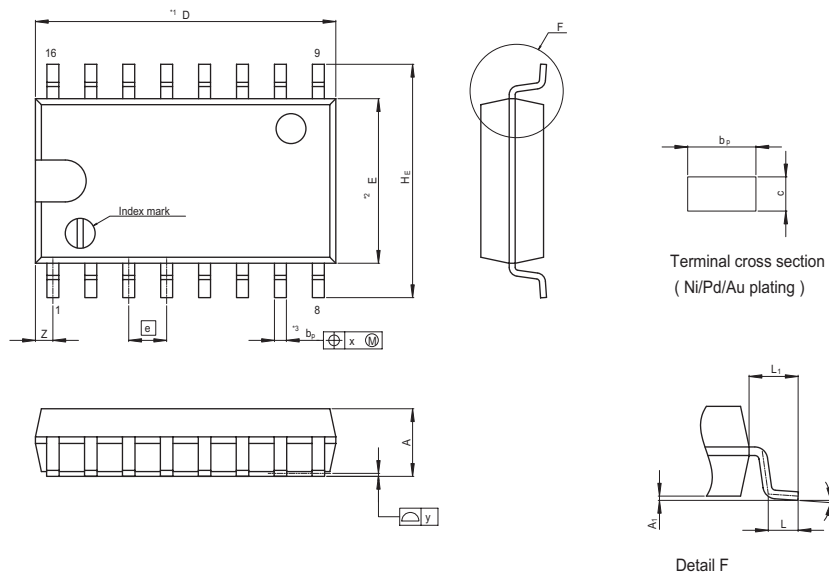
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19.2-2.54	PRDP0016AE-B	DP-16FV	1.05g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e <sub>1</sub>	—	7.62	—
D	—	19.2	20.32
E	—	6.3	7.4
A	—	—	5.06
A <sub>1</sub>	0.51	—	—
b <sub>p</sub>	0.40	0.48	0.56
b <sub>3</sub>	—	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	—	—

( Ni/Pd/Au plating )

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.

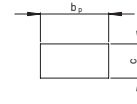
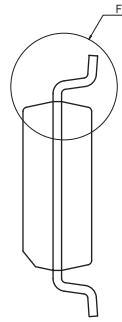
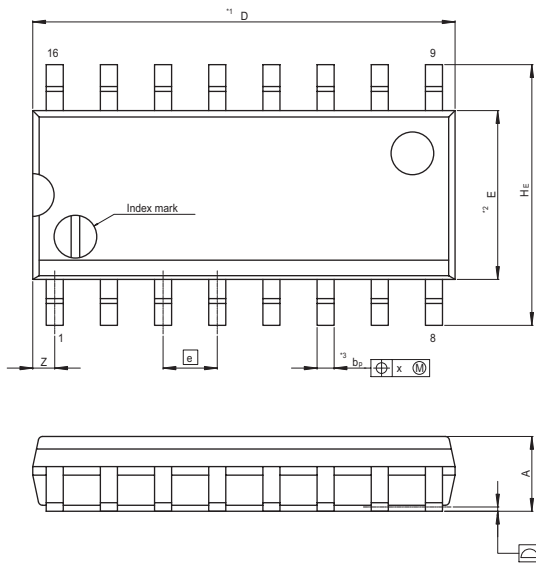
Terminal cross section  
 ( Ni/Pd/Au plating )

Detail F

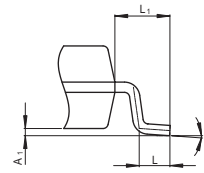
Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	10.06	10.5
E	—	5.50	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.00	0.10	0.20
A	—	—	2.20
b <sub>p</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
HE	7.50	7.80	8.00
Ⓜ	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.80
L	0.50	0.70	0.90
L <sub>1</sub>	—	1.15	—

# HD74HC4051

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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