

# HD74HC4066

## Quad Analog Switches/Quad Multiplexers

REJ03D0651-0200  
 (Previous ADE-205-538)  
 Rev.2.00  
 Mar 30, 2006

### Description

This switch has low “on” resistance and low “off” leakage. It is a bidirectional switch, thus any analog input may be used as an output and vice-versa. Also the HD74HC4066 switch contains linearization circuitry which lowers the “on” resistance and increases switch linearity. The HD74HC4066 device allows control of up to 12 V (peak) analog signals with digital control signals of the same range. Each switch has its own control input which disables each switch when low.

### Features

- High Speed Operation
- Wide Operating Voltage:  $V_{CC} = 2$  to  $6$  V
- Low Quiescent Supply Current:  $I_{CC}$  (static) =  $1 \mu\text{A}$  max ( $T_a = 25^\circ\text{C}$ )
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC4066P	DILP-14 pin	PRDP0014AB-B (DP-14AV)	P	—
HD74HC4066FPEL	SOP-14 pin (JEITA)	PRSP0014DF-B (FP-14DAV)	FP	EL (2,000 pcs/reel)
HD74HC4066RPEL	SOP-14 pin (JEDEC)	PRSP0014DE-A (FP-14DNV)	RP	EL (2,500 pcs/reel)
HD74HC4066TELL	TSSOP-14 pin	PTSP0014JA-B (TTP-14DV)	T	ELL (2,000 pcs/reel)

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

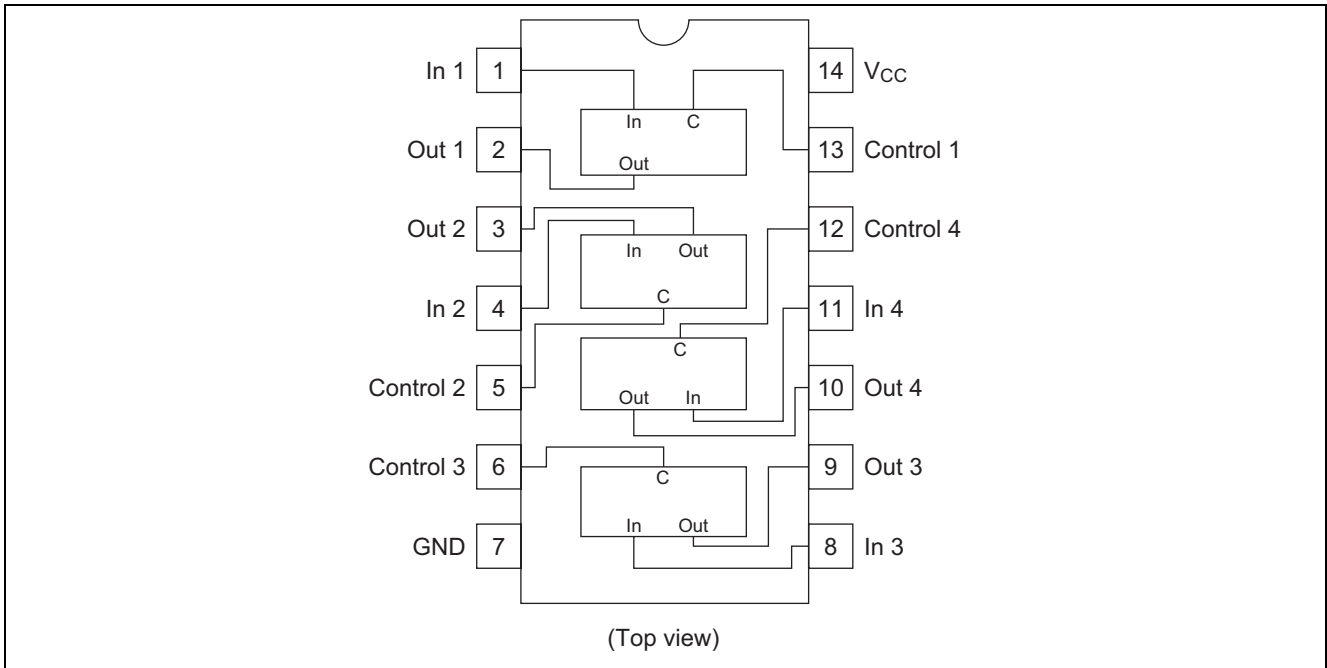
### Function Table

Control	Switch
L	OFF
H	ON

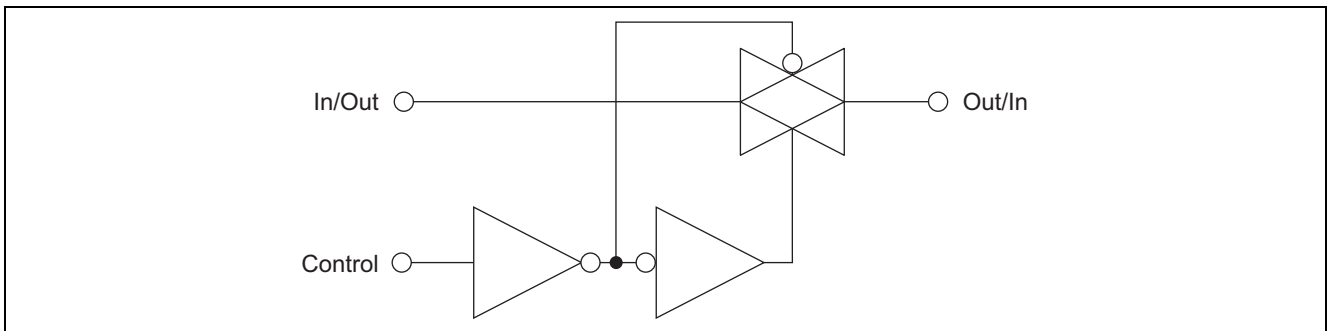
$GND \leq V_{in} \leq V_{CC}$

$GND \leq V_{out} \leq V_{CC}$

### Pin Arrangement



### Logic Diagram



### Absolute Maximum Ratings

Item	Symbol	Rating	Unit	
Supply voltage	$V_{CC}$	-0.5 to +7.0	V	
Control input voltage	$V_C$	-0.5 to $V_{CC} + 0.5$	V	
Switch I/O voltage	$V_{IN/OUT}$	-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)	$I_{IN/OUT}$	$\pm 25$	mA	
Control input diode current	$I_{IK}$	$\pm 20$	mA	
Switch I/O diode current	$I_{IOK}$	$\pm 20$	mA	
Power dissipation	$P_T$	500	mW	
Storage temperature range	$T_{stg}$	-65 to +150	$^{\circ}C$	

## Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	
Supply voltage	$V_{CC}$	2	—	6	V	
Control input voltage	$V_C$	0	—	$V_{CC}$	V	
Switch I/O voltage	$V_{IN/OUT}$	0	—	$V_{CC}$	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

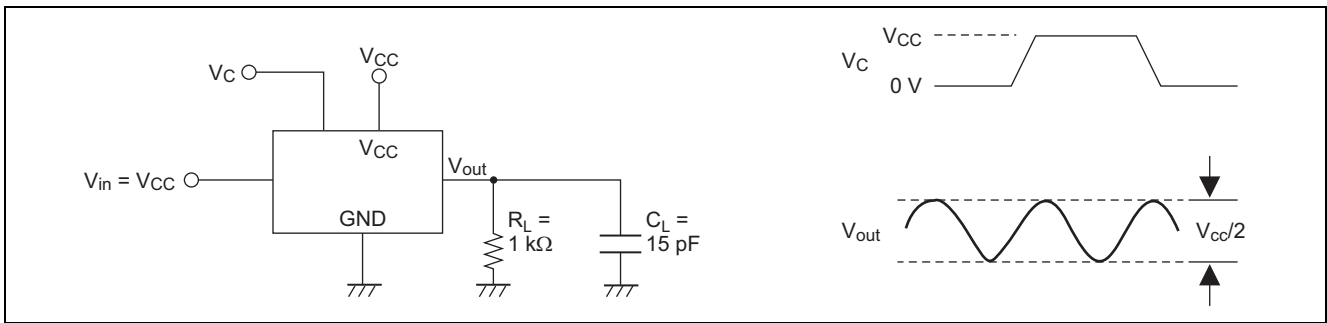
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }+85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Control input voltage	$V_{IH}$	2.0	1.5	—	—	1.5	—	V	
		4.5	3.15	—	—	3.15	—		
		6.0	4.2	—	—	4.2	—		
	$V_{IL}$	2.0	—	—	0.5	—	0.5	V	
		4.5	—	—	1.35	—	1.35		
		6.0	—	—	1.8	—	1.8		
“ON” resistance	$R_{ON}$	2.0	—	2000	5000	—	6250	$\Omega$	$V_C = V_{IH}$ $V_{in} = 0\text{ to }V_{CC}$ $I_{in/out} = 1\text{ mA}$
		4.5	—	100	200	—	250		
		6.0	—	60	170	—	210		
$\Delta$ ON resistance between any two channels	$\Delta R_{ON}$	2.0	—	50	—	—	—	$\Omega$	$V_C = V_{IH}$ , $I_{in/out} = 1\text{ mA}$ between any two channels
		4.5	—	3	—	—	—		
		6.0	—	2	—	—	—		
OFF channel leakage current (switch off)	$I_{S(OFF)}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_C = V_{IL}$ $V_{IN} = V_{CC}$ , $V_{out} = \text{GND}$ or, $V_{in} = \text{GND}$ , $V_{out} = V_{CC}$
OFF channel leakage current (switch on)	$I_{S(ON)}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_C = V_{IH}$ $V_{in} = V_{CC}$ or GND
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	—	—	1.0	—	10.0	$\mu\text{A}$	$V_{in} = V_{CC}$ or GND

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

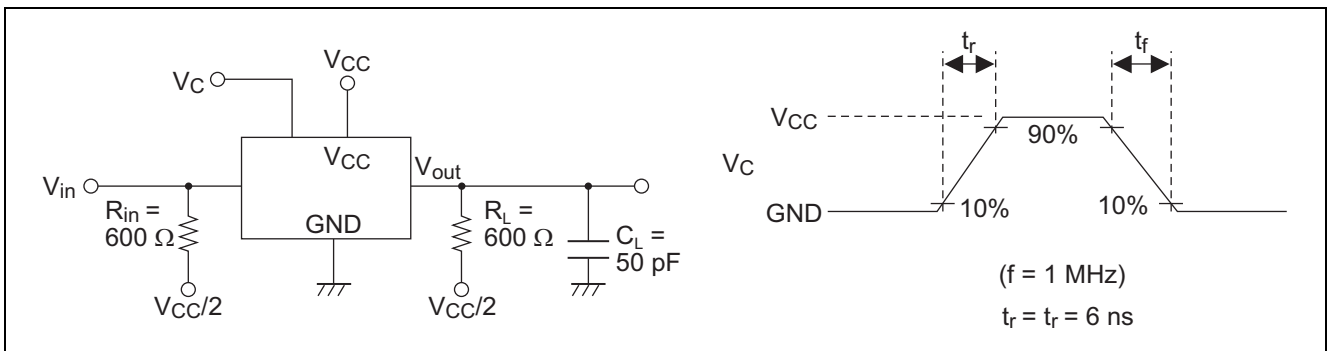
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } +85^\circ\text{C}$		Unit	Test Conditions
			Min	Typ	Max	Min	Max		
Propagation delay time	$t_{PLH}$	2.0	—	25	60	—	75	ns	$R_L = 10 \text{ k}\Omega$ Switch input to switch output
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
	$t_{PHL}$	2.0	—	25	60	—	75		
		4.5	—	6	12	—	15		
		6.0	—	5	10	—	13		
Propagation delay time	$t_{PLH}$	2.0	—	—	50	—	65	ns	$R_L = 10 \text{ k}\Omega$
	$t_{PHT}$	4.5	—	4	10	—	13		
	6.0	—	—	9	—	11			
Output enable time	$t_{ZH}$	2.0	—	—	115	—	145	ns	$R_L = 1 \text{ k}\Omega$
		4.5	—	10	23	—	29		
		6.0	—	—	20	—	25		
Output disable time	$t_{LZ}$ $t_{HZ}$	2.0	—	—	115	—	145	ns	$R_L = 1 \text{ k}\Omega$
		4.5	—	14	23	—	29		
		6.0	—	—	20	—	25		
Sine wave distortion		4.5	—	0.05	—	—	—	%	$R_L = 10 \text{ k}\Omega$ , $C_L = 50 \text{ pF}$ , $f_{IN} = 1 \text{ kHz}$
Band width (-3 dB)		4.5	—	30	—	—	—	MHz	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ , $20 \log_{10} V_{out}/V_{in} = -3\text{dB}$
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 to signal I/O		2.0	—	25	—	—	—	mA	$R_L = 600 \Omega$ , $C_L = 50 \text{ pF}$ , $f_{IN} = 1 \text{ MHz}$
		4.5	—	60	—	—	—		
		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	—	—	—		
Control input capacitance	$C_{in}$		—	5	10	—	10	pF	
Switch I/O capacitance	$C_{in/out}$		—	6	—	—	—	pF	
Feed through capacitance	$C_{in/out}$		—	0.5	—	—	—	pF	
Power dissipation capacitance	$C_{PD}$		—	13	—	—	—	pF	

## Test Circuit

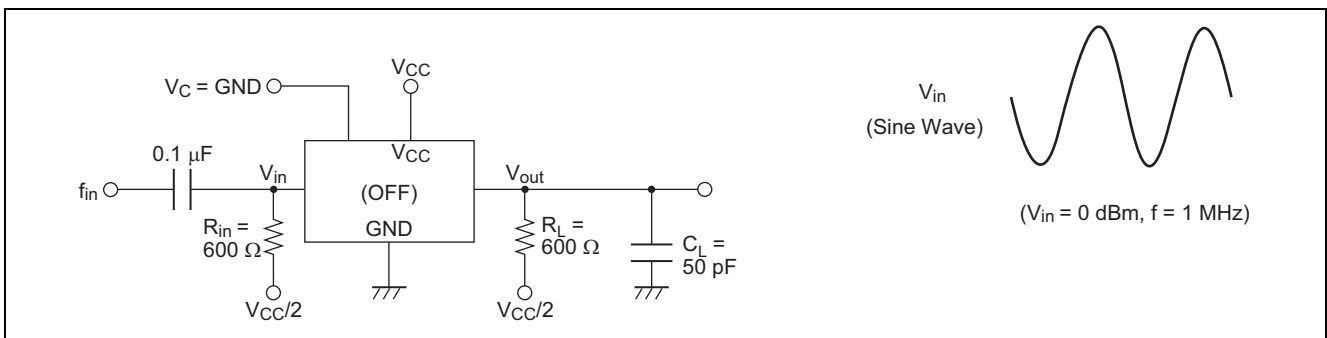
### Maximum Control Frequency



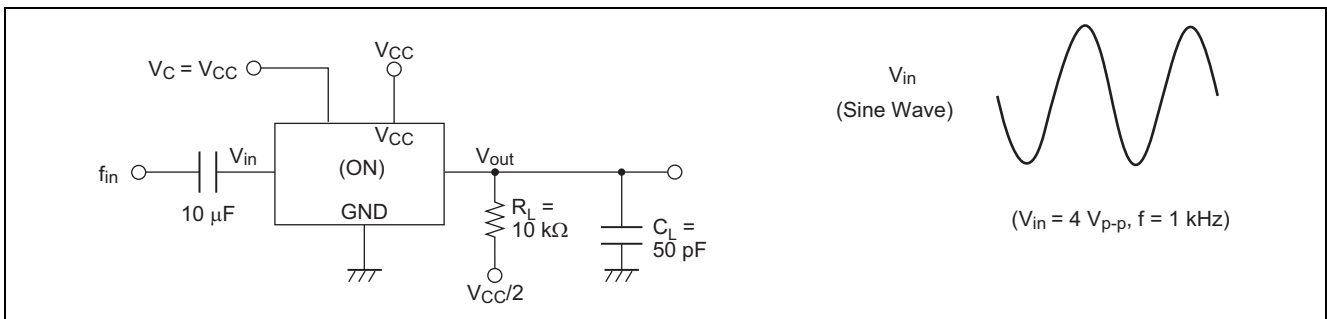
### Cross talk (Control Input to Switch Output)



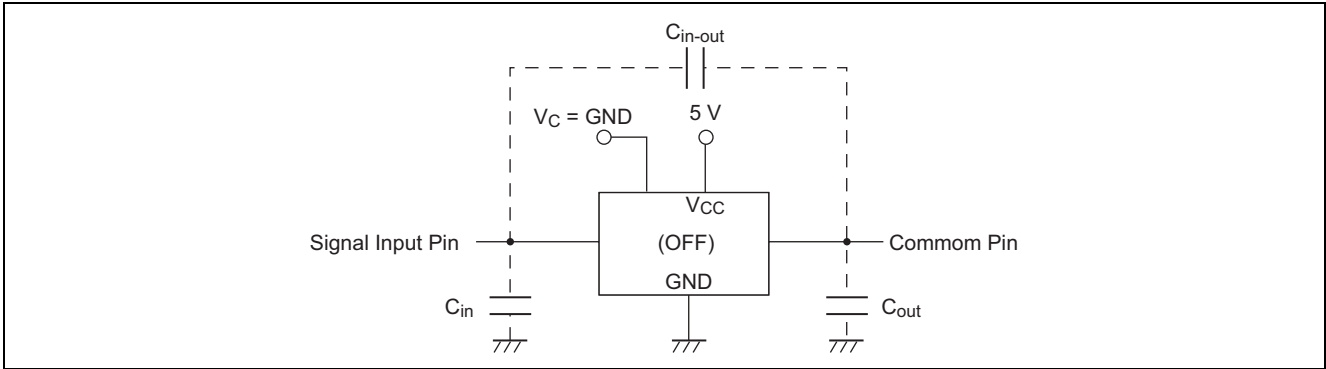
### Feed through Attenuation



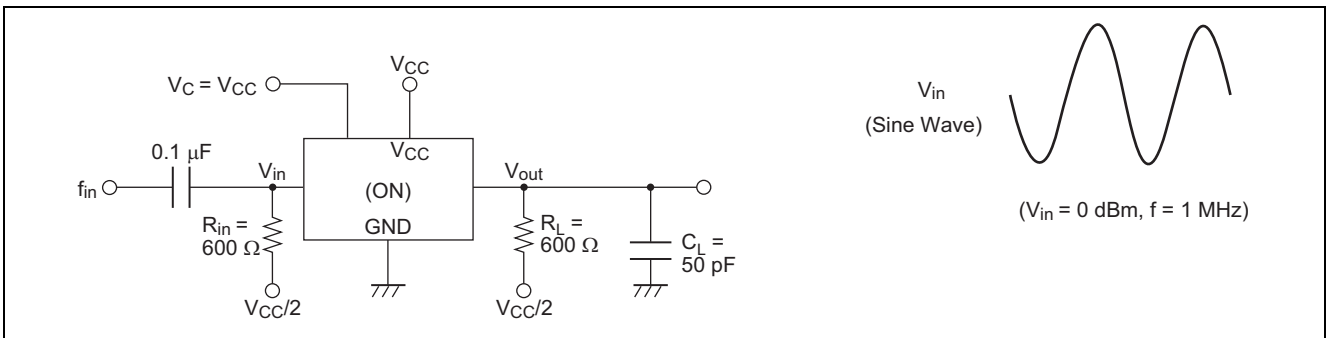
### Sine Wave Distortion



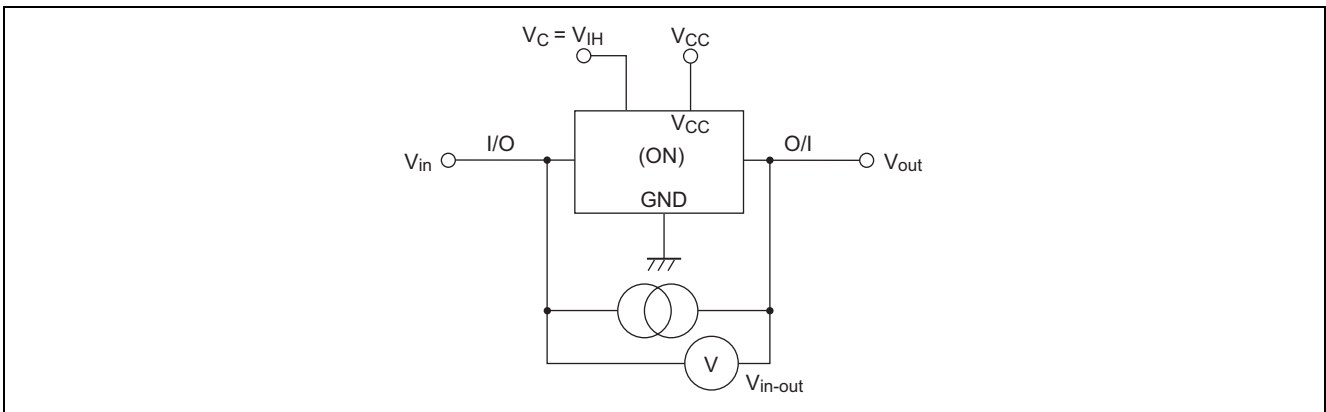
**C<sub>in</sub>, C<sub>out</sub>, C<sub>in-out</sub> (Input, Output, and Feed through Capacitance)**



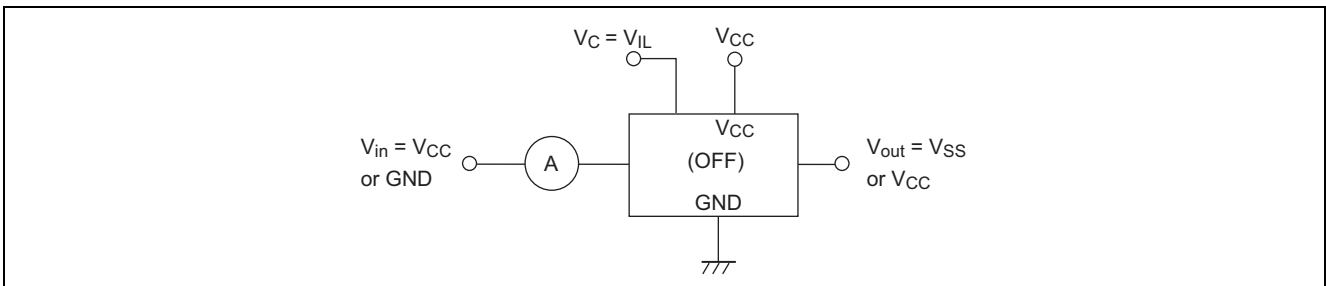
**Switch Frequency Response Band Width (-3dB)**



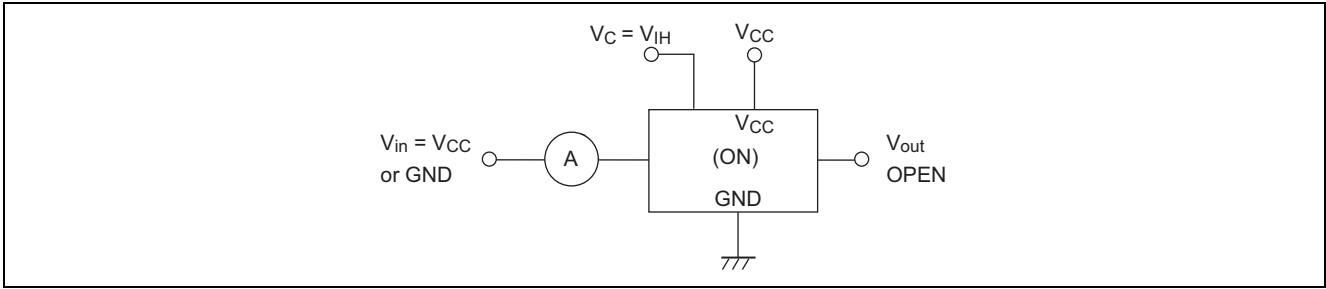
**R<sub>ON</sub>: ON Resistance**



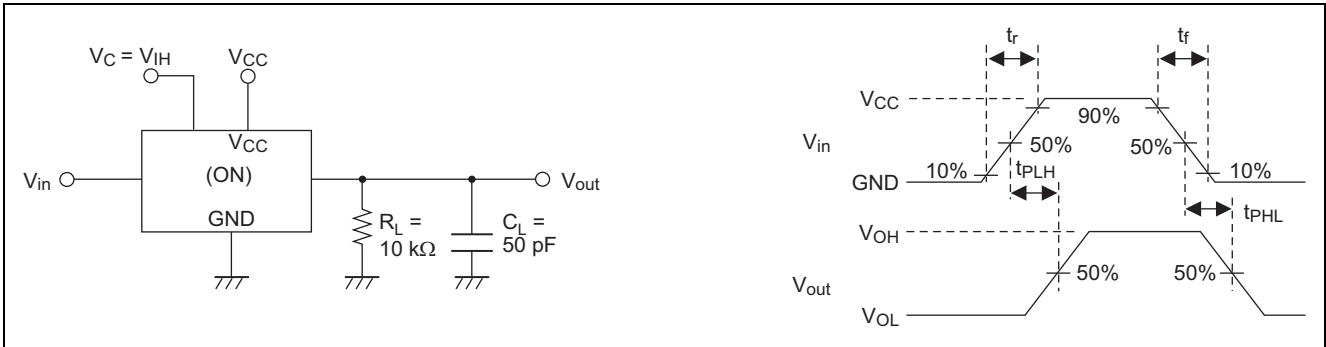
**I<sub>s</sub> (OFF): OFF Channel Leakage Current (Switch OFF)**



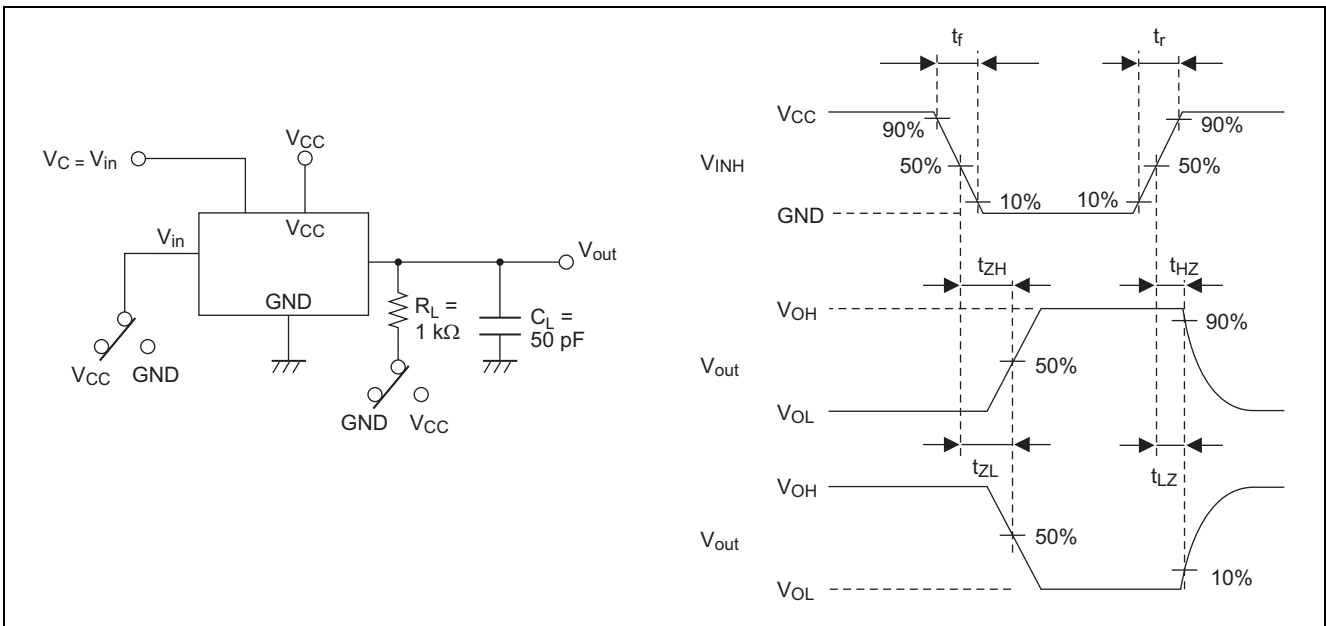
**$I_s$  (ON): OFF Channel Leakage Current (Switch ON)**



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

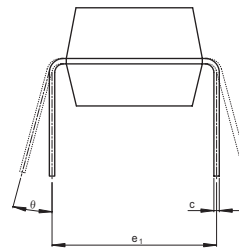
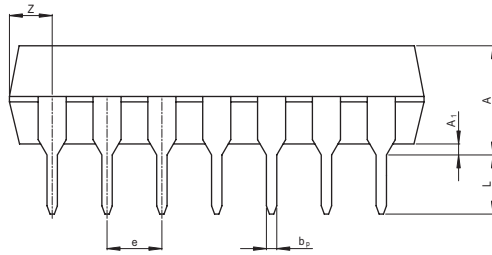
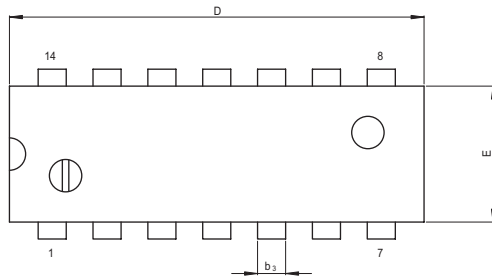


**$t_{ZH}$ ,  $t_{ZL}/t_{HZ}$ ,  $t_{LZ}$ : Output Enable and Disable Time**



Package Dimensions

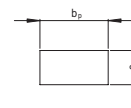
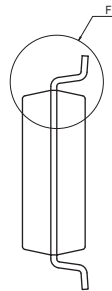
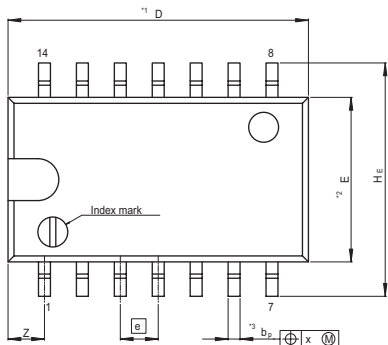
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP14-6.3x19.2-2.54	PRDP0014AB-B	DP-14AV	0.97g



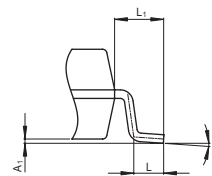
(Ni/Pd/Au plating)

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	—	—	2.39
L	2.54	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-5.5x10.06-1.27	PRSP0014DF-B	FP-14DAV	0.23g



Terminal cross section (Ni/Pd/Au plating)



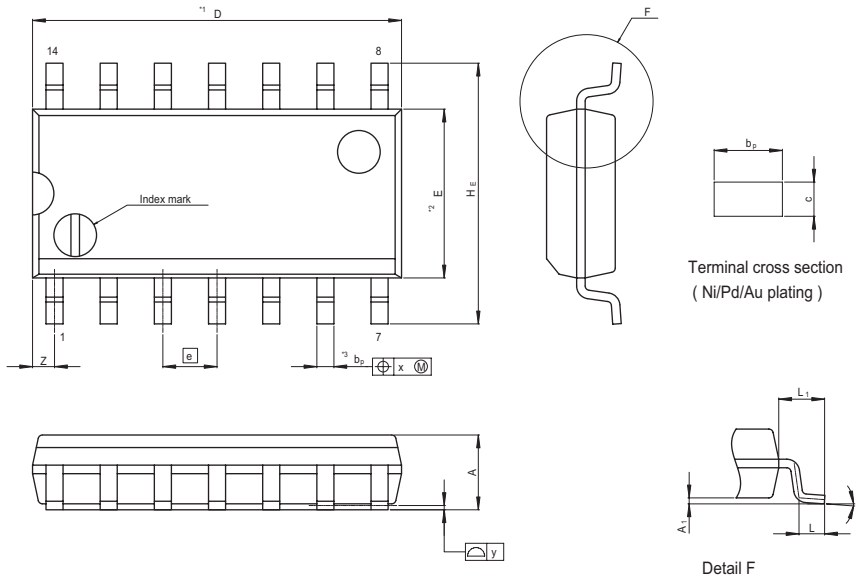
Detail F

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	—	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°
H <sub>E</sub>	7.50	7.80	8.00
Ⓧ	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	1.42
L	0.50	0.70	0.90
L <sub>1</sub>	—	1.15	—



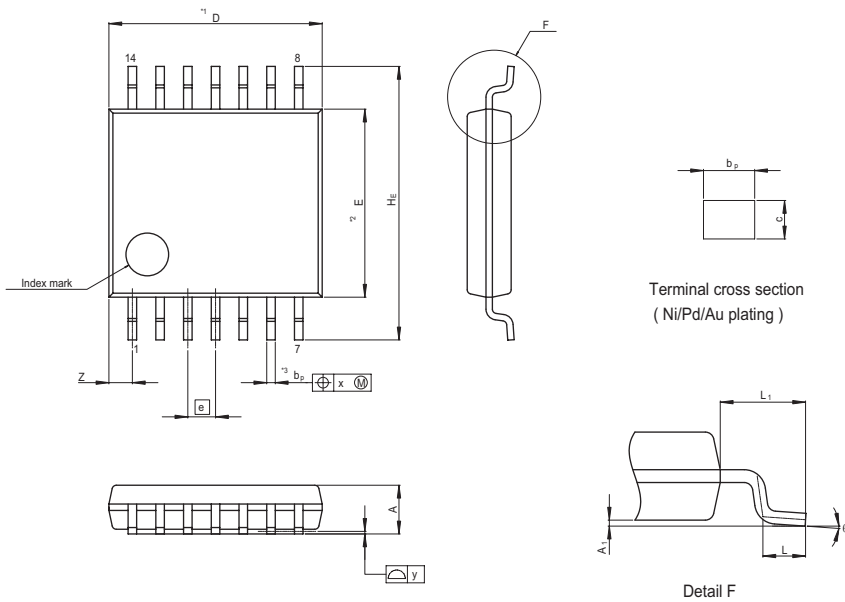
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-3.95x8.65-1.27	PRSP0014DE-A	FP-14DNV	0.13g



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	—	8.65	9.05
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
e	—	1.27	—
x	—	—	0.25
y	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L <sub>1</sub>	—	1.08	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP14-4.4x5-0.65	PTSP0014JA-B	TTP-14DV	0.05g



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	—	5.00	5.30
E	—	4.40	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.03	0.07	0.10
A	—	—	1.10
b <sub>p</sub>	0.15	0.20	0.25
b <sub>1</sub>	—	—	—
c	0.10	0.15	0.20
c <sub>1</sub>	—	—	—
θ	0°	—	8°
HE	6.20	6.40	6.60
e	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.83
L	0.4	0.5	0.6
L <sub>1</sub>	—	1.0	—

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