

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.

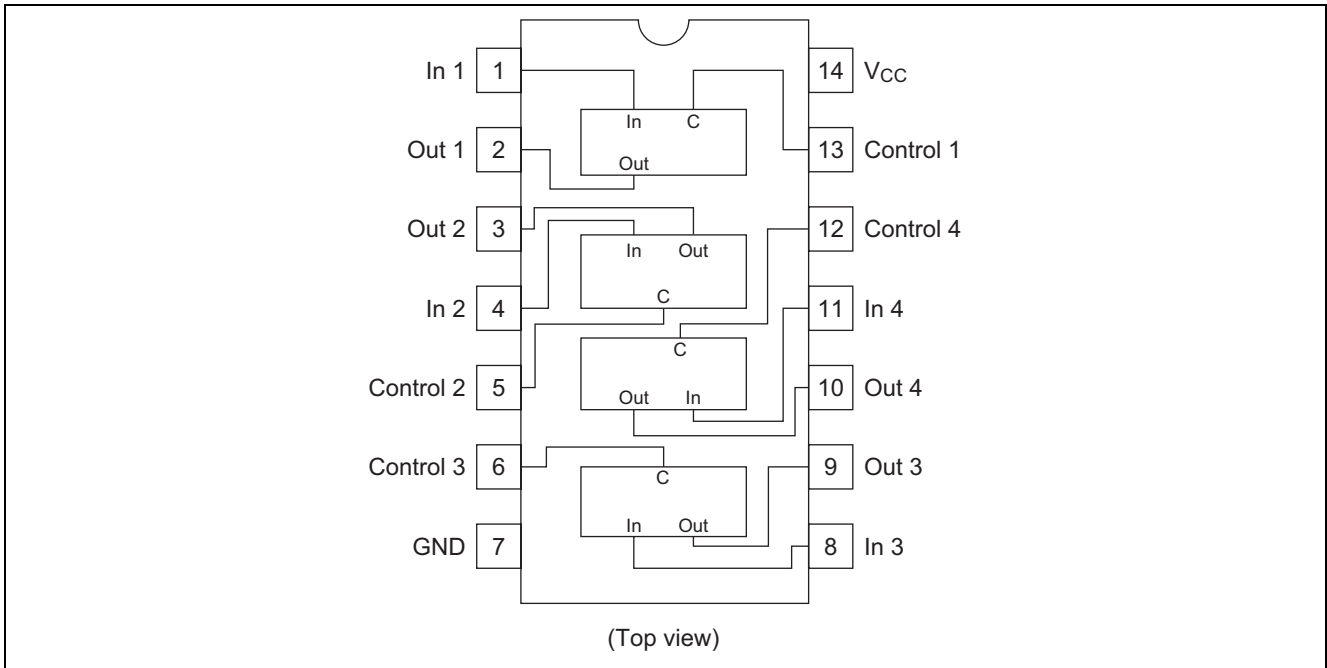
Function Table

| Control | Switch |
|---------|--------|
| L | OFF |
| H | ON |

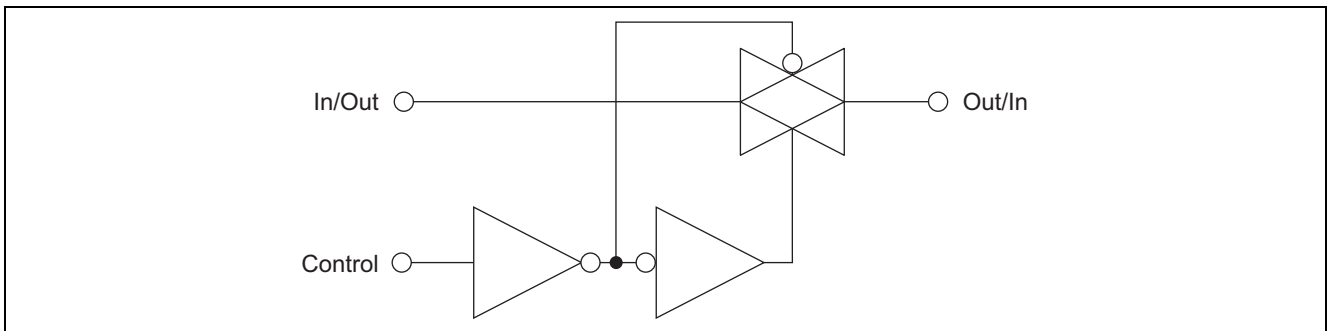
$GND \leq V_{in} \leq V_{CC}$

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

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) | $I_{IN/OUT}$ | ± 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 | $^{\circ}C$ | |

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

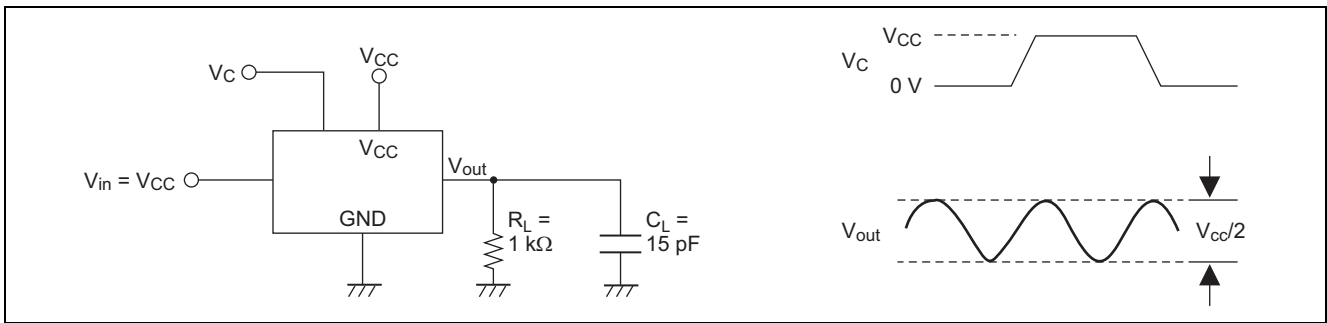
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40\text{ to }+85^\circ\text{C}$ | | Unit | Test Conditions |
|---|-----------------|--------------|--------------------------|------|-----------|---|-----------|---------------|---|
| | | | Min | Typ | Max | Min | Max | | |
| Control 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 | Ω | $V_C = V_{IH}$ $V_{in} = 0\text{ to }V_{CC}$ $I_{in/out} = 1\text{ mA}$ |
| | | 4.5 | — | 100 | 200 | — | 250 | | |
| | | 6.0 | — | 60 | 170 | — | 210 | | |
| Δ ON resistance between any two channels | ΔR_{ON} | 2.0 | — | 50 | — | — | — | Ω | $V_C = V_{IH}$, $I_{in/out} = 1\text{ mA}$ between any two channels |
| | | 4.5 | — | 3 | — | — | — | | |
| | | 6.0 | — | 2 | — | — | — | | |
| OFF channel leakage current (switch off) | $I_{S(OFF)}$ | 6.0 | — | — | ± 0.1 | — | ± 1.0 | μA | $V_C = V_{IL}$ $V_{IN} = V_{CC}$, $V_{out} = \text{GND}$ or, $V_{in} = \text{GND}$, $V_{out} = V_{CC}$ |
| OFF channel leakage current (switch on) | $I_{S(ON)}$ | 6.0 | — | — | ± 0.1 | — | ± 1.0 | μA | $V_C = V_{IH}$ $V_{in} = V_{CC}$ or GND |
| 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 | — | — | 1.0 | — | 10.0 | μA | $V_{in} = V_{CC}$ or GND |

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

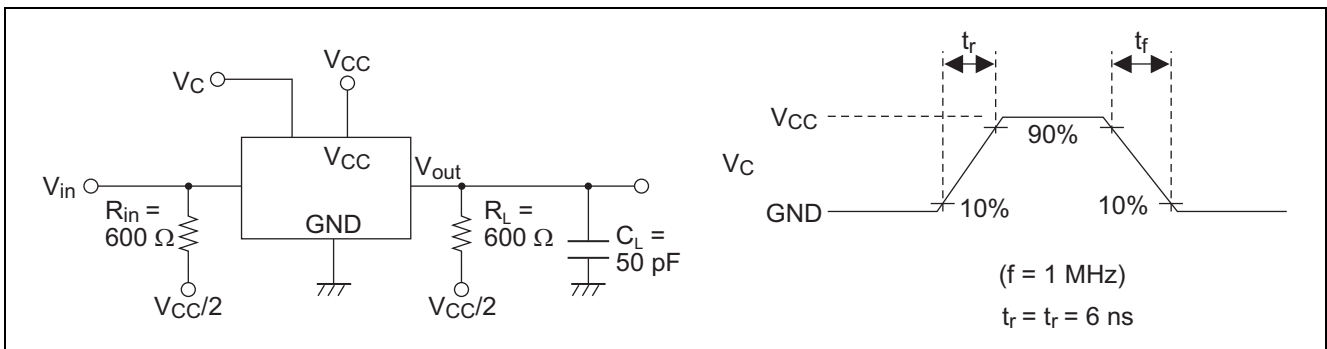
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | $T_a = -40 \text{ to } +85^\circ\text{C}$ | | Unit | Test Conditions |
|--|----------------------|--------------|--------------------------|------|-----|---|-----|------|---|
| | | | Min | Typ | Max | Min | Max | | |
| Propagation delay time | 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 | | |
| | | 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

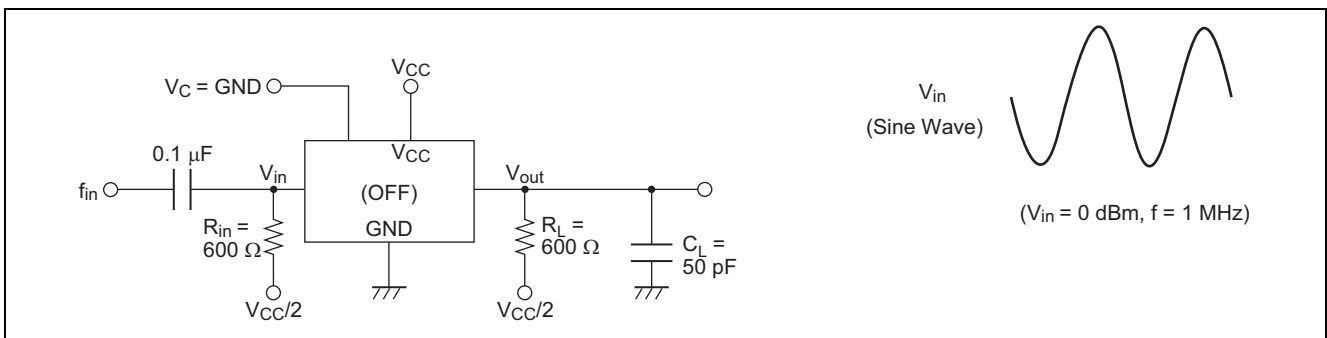
Maximum Control Frequency



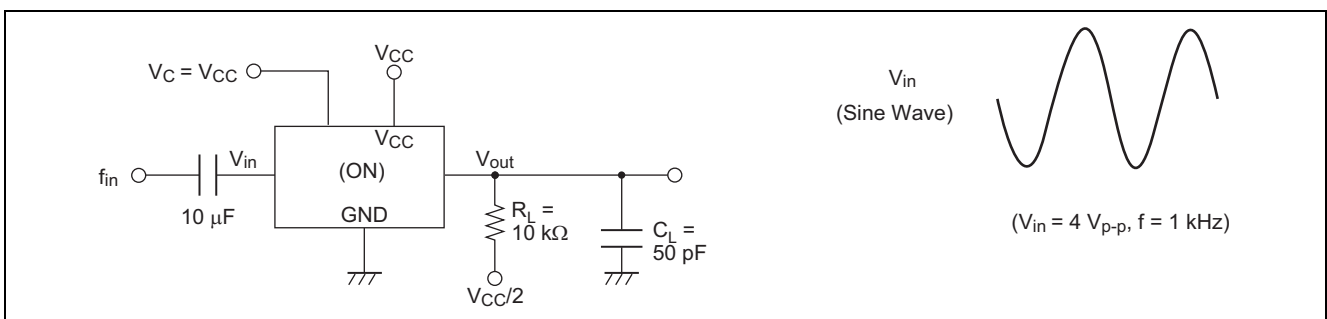
Cross talk (Control Input to Switch Output)



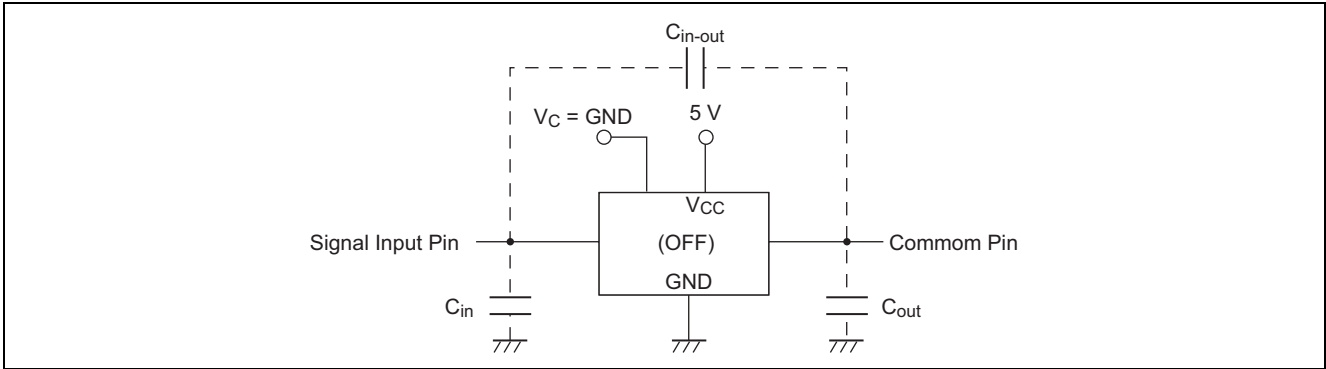
Feed through Attenuation



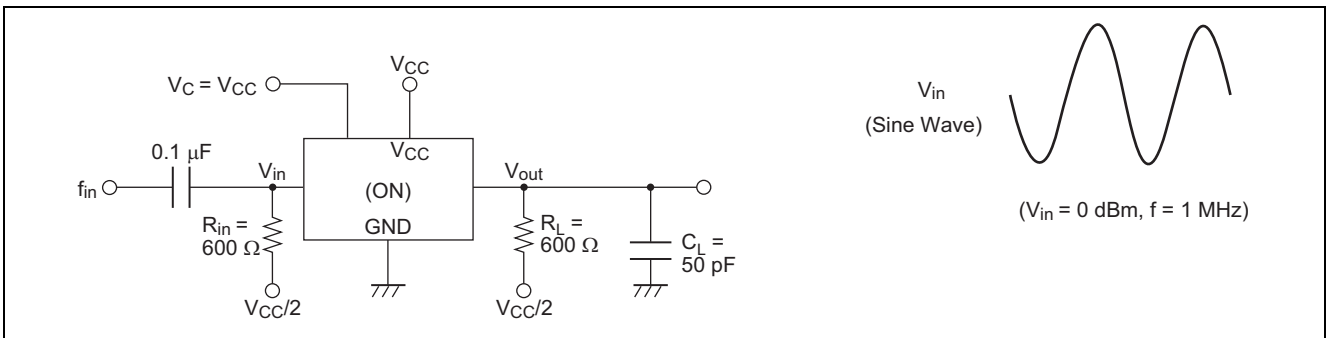
Sine Wave Distortion



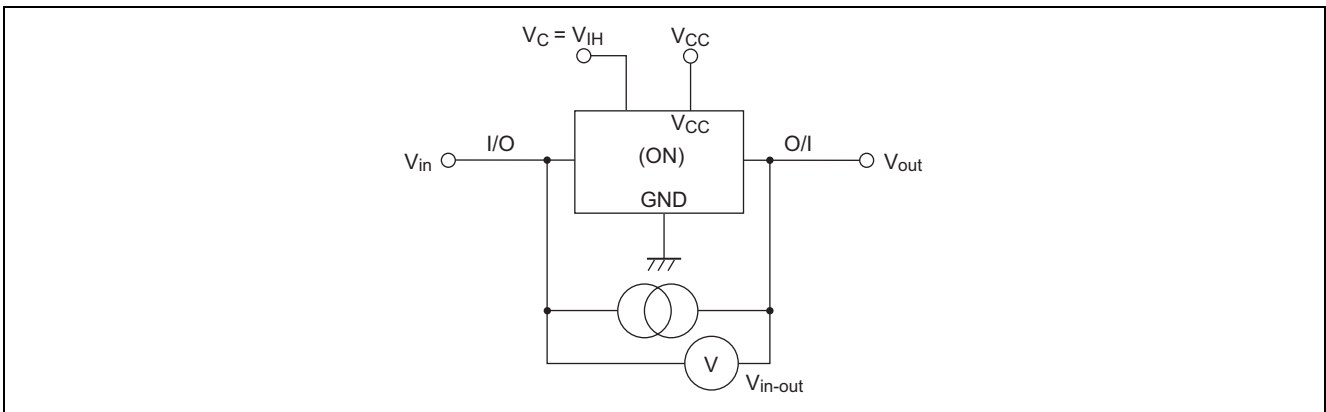
C_{in}, C_{out}, C_{in-out} (Input, Output, and Feed through Capacitance)



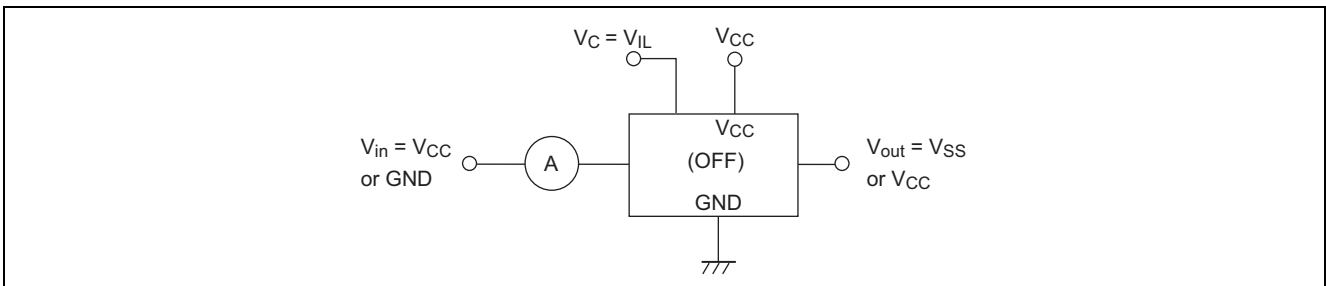
Switch Frequency Response Band Width (-3dB)



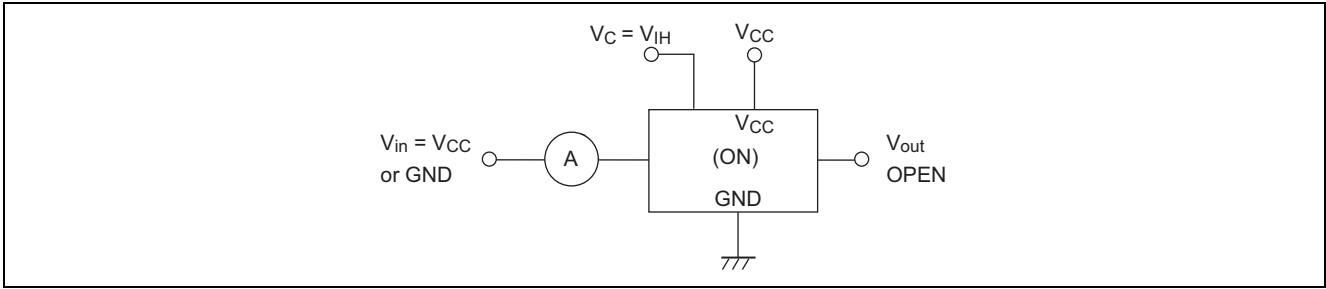
R_{ON}: ON Resistance



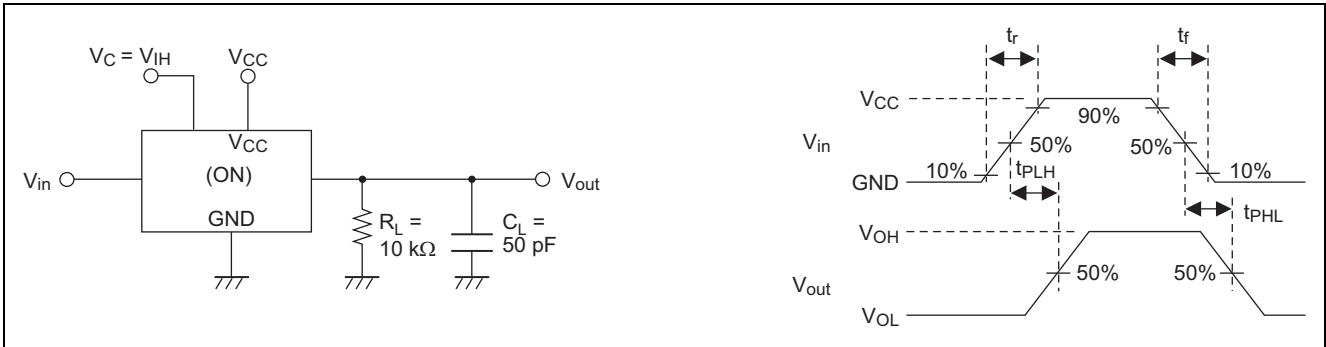
I_s (OFF): OFF Channel Leakage Current (Switch OFF)



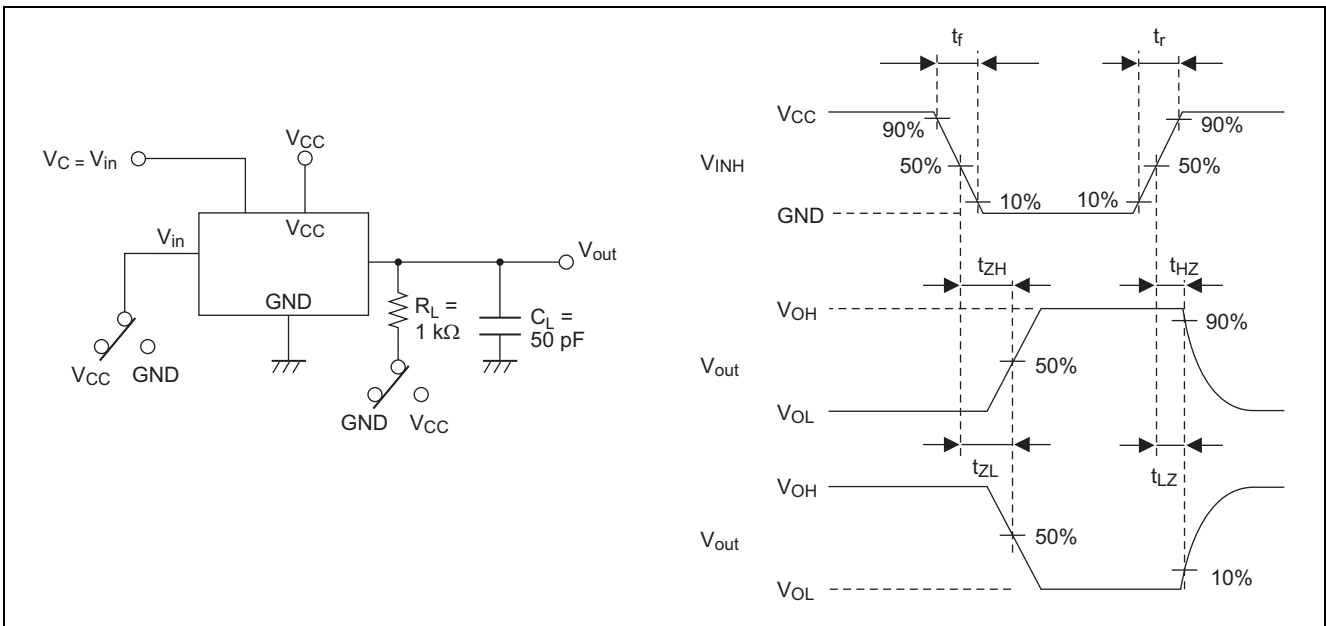
I_s (ON): OFF Channel Leakage Current (Switch ON)



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

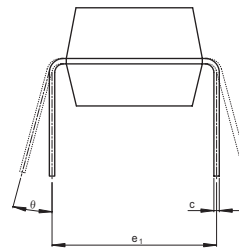
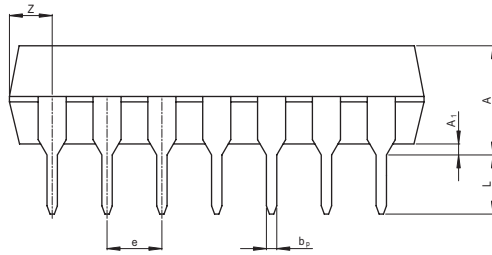
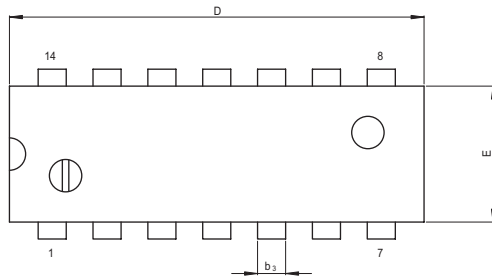


t_{ZH} , t_{ZL}/t_{HZ} , t_{LZ} : Output Enable and Disable Time



Package Dimensions

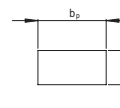
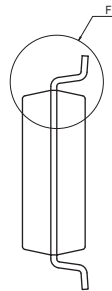
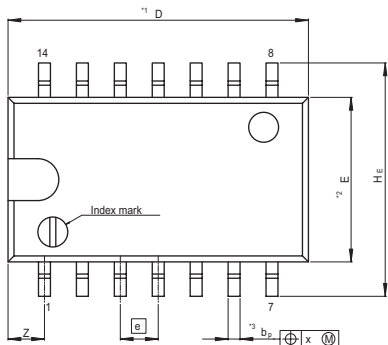
| | | | |
|-----------------------|--------------|---------------|------------|
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
| P-DIP14-6.3x19.2-2.54 | PRDP0014AB-B | DP-14AV | 0.97g |



(Ni/Pd/Au plating)

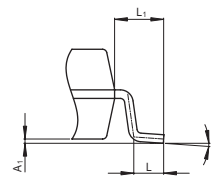
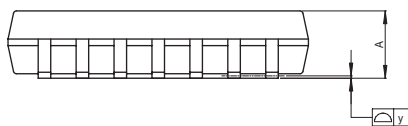
| Reference Symbol | Dimension in Millimeters | | |
|------------------|--------------------------|------|-------|
| | Min | Nom | Max |
| e ₁ | — | 7.62 | — |
| D | — | 19.2 | 20.32 |
| E | — | 6.3 | 7.4 |
| A | — | — | 5.06 |
| A ₁ | 0.51 | — | — |
| b _p | 0.40 | 0.48 | 0.56 |
| b ₃ | — | 1.30 | — |
| c | 0.19 | 0.25 | 0.31 |
| θ | 0° | — | 15° |
| e | 2.29 | 2.54 | 2.79 |
| Z | — | — | 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)

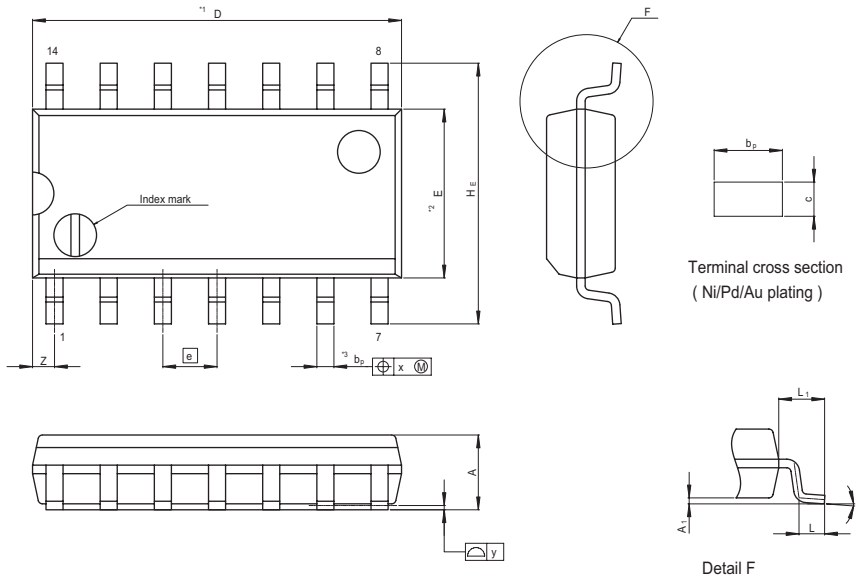
NOTE)
 1. DIMENSIONS**1 (Nom)*AND**2 DO NOT INCLUDE MOLD FLASH.
 2. DIMENSION**3*DOES NOT INCLUDE TRIM OFFSET.



Detail F

| 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 |
| Ⓞ | — | 1.27 | — |
| x | — | — | 0.12 |
| y | — | — | 0.15 |
| Z | — | — | 1.42 |
| L | 0.50 | 0.70 | 0.90 |
| L ₁ | — | 1.15 | — |

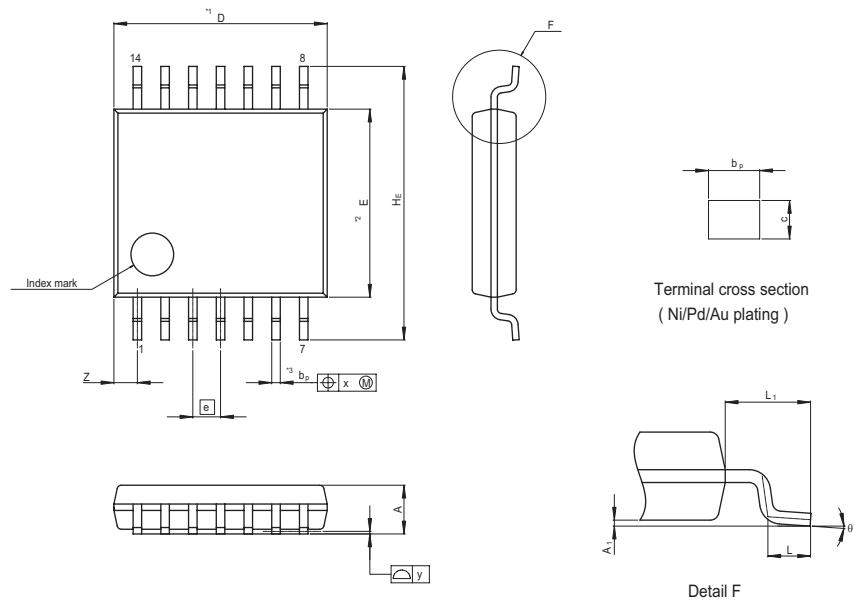
| | | | |
|------------------------|--------------|---------------|------------|
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
| P-SOP14-3.95x8.65-1.27 | PRSP0014DE-A | FP-14DNV | 0.13g |



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 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 | — |

| | | | |
|----------------------|--------------|---------------|------------|
| 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 ₂ | — | — | — |
| A ₁ | 0.03 | 0.07 | 0.10 |
| A | — | — | 1.10 |
| b _p | 0.15 | 0.20 | 0.25 |
| b ₁ | — | — | — |
| c | 0.10 | 0.15 | 0.20 |
| c ₁ | — | — | — |
| θ | 0° | — | 8° |
| HE | 6.20 | 6.40 | 6.60 |
| Ⓜ | — | 0.65 | — |
| x | — | — | 0.13 |
| y | — | — | 0.10 |
| Z | — | — | 0.83 |
| L | 0.4 | 0.5 | 0.6 |
| L ₁ | — | 1.0 | — |

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450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.

Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7898

Renesas Technology Hong Kong Ltd.

7th Floor, North Tower, World Finance Centre, Harbour City, 1 Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.

10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology Singapore Pte. Ltd.

1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.

Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd

Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510