

HD14051B

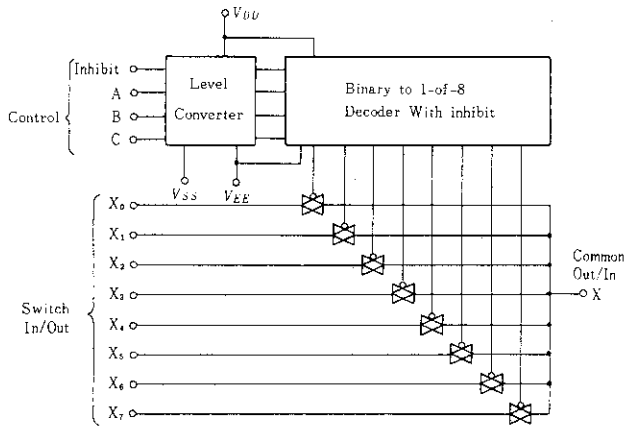
8-channel Analog Multiplexer/Demultiplexer

The HD14051B analog multiplexer is digitally controlled analog switch effectively implements an SP8T electronic switch and features low ON impedance and very low OFF leakage current. Control of analog signals up to the complete supply voltage range can be achieved.

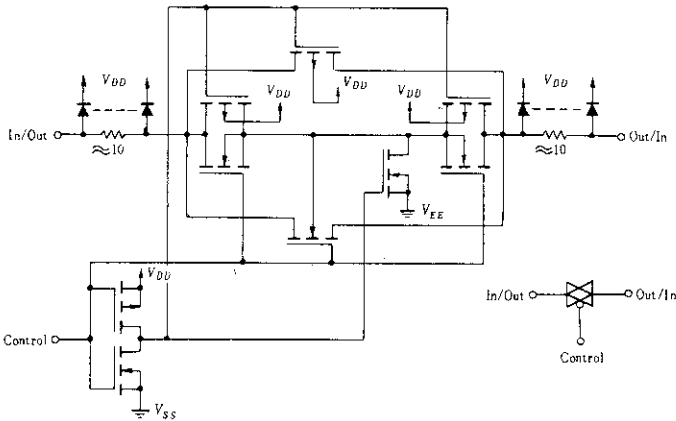
FEATURES

- High On/Off Output Voltage Ratio = 65dB typ.
- Quiescent Current = 5nA/pkg typ. @5V
- Low Crosstalk Between Switches = 80dB typ.
- Supply Voltage Range = 3 to 18V
- Linearized Transfer Characteristics, $\Delta R_{ON} < 60\Omega$ for $V_{in} = V_{DD}$ to V_{EE} @ 15V
- Pin-for-Pin Replacement for CD4051 and MC14051B

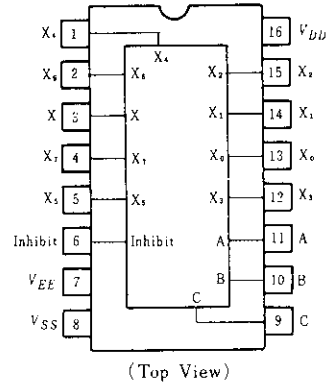
BLOCK DIAGRAM



SWITCH CIRCUIT SCHEMATIC



PIN ARRANGEMENT



TRUTH TABLE

| Control Inputs | | | | ON Switch |
|----------------|---|---|---|----------------|
| Inhibit | C | B | A | |
| 0 | 0 | 0 | 0 | X ₀ |
| 0 | 0 | 0 | 1 | X ₁ |
| 0 | 0 | 1 | 0 | X ₂ |
| 0 | 0 | 1 | 1 | X ₃ |
| 0 | 1 | 0 | 0 | X ₄ |
| 0 | 1 | 0 | 1 | X ₅ |
| 0 | 1 | 1 | 0 | X ₆ |
| 0 | 1 | 1 | 1 | X ₇ |
| 1 | x | x | x | — |

x=Don't Care

■ MAXIMUM RATINGS (Voltages referenced to V_{SS})

| Characteristic | Symbol | Value | Unit |
|-----------------------------|-----------------|-----------------------------|-----------|
| DC Supply Voltage | $V_{DD}-V_{EE}$ | -0.5~+18 | V_{DC} |
| Control Input Voltage | V_{in} | $V_{SS}-0.5\sim V_{DD}+0.5$ | V_{OC} |
| Signal Voltage | V_{sig} | $V_{EE}-0.5\sim V_{DD}+0.5$ | V_{P-P} |
| Control Input Current | I_{in} | ± 10 | mA |
| Signal Current | I_{sig} | 25 | mA |
| Operating Temperature Range | T_A | -40~+85 | °C |
| Storage Temperature Range | T_{stg} | -65~+150 | °C |
| Power Dissipation | P_D | 300 | mW |

■ ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | $V_{DD}(V)$ | Test Conditions | -40°C | | 25°C | | | 85°C | | Unit | |
|--|------------------|-------------|--|------------|------|------|------------|------|------|------|----------|----|
| | | | | min | max | min | typ | max | min | max | | |
| Input Voltage | V_{IL} | 5.0 | $R_L=10k\Omega$ $V_o=0.5V$ | - | 1.5 | - | 2.25 | 1.5 | - | 1.5 | V | |
| | | 10 | SW入力 = V_{DD} $V_o=1.0V$ | - | 3.0 | - | 4.50 | 3.0 | - | 3.0 | | |
| | | 15 | $V_{EE}=V_{SS}$ $V_o=1.5V$ | - | 4.0 | - | 6.75 | 4.0 | - | 4.0 | | |
| | V_{IH} | 5.0 | $R_L=10k\Omega$ $V_o=4.0V$ | 3.5 | - | 3.5 | 2.75 | - | 3.5 | - | V | |
| | | 10 | SW入力 = V_{DD} $V_o=9.0V$ | 7.0 | - | 7.0 | 5.50 | - | 7.0 | - | | |
| | | 15 | $V_{EE}=V_{SS}$ $V_o=13.5V$ | 11.0 | - | 11.0 | 8.25 | - | 11.0 | - | | |
| Input Current | I_{in} | | Control, Inhibit | - | - | - | 10 | - | - | - | pA | |
| Input Capacitance | Control, Inhibit | C_{in} | | $V_{in}=0$ | - | - | - | 5.0 | - | - | - | pF |
| | Switch Inputs | | | | - | - | - | 10 | - | - | - | |
| Output Capacitance | C_{out} | 10 | | - | - | - | 60 | - | - | - | pF | |
| Feedthrough Capacitance | C_{in-out} | 10 | | - | - | - | 0.18 | - | - | - | pF | |
| Quiescent Current | I_{DD} | 5.0 | Zero Signal, per Package | - | 20 | - | 0.005 | 20 | - | 150 | μA | |
| | | 10 | | - | 40 | - | 0.010 | 40 | - | 300 | | |
| | | 15 | | - | 80 | - | 0.015 | 80 | - | 600 | | |
| Total Supply Current | I_T | 5.0 | Dynamic + I_{DD} , per Gate $f=1kHz$ | - | - | - | 0.07 | - | - | - | μA | |
| | | 10 | | - | - | - | 0.20 | - | - | - | | |
| | | 15 | | - | - | - | 0.36 | - | - | - | | |
| ON Resistance | R_{ON} | 5.0 | | - | 880 | - | 250 | 1050 | - | 1200 | Ω | |
| | | 10 | | - | 450 | - | 120 | 500 | - | 520 | | |
| | | 15 | | - | 250 | - | 80 | 280 | - | 300 | | |
| ΔR_{ON} Between Any Two Channels | ΔR_{ON} | 5.0 | Two Channels | - | - | - | 25 | - | - | - | Ω | |
| | | 10 | | - | - | - | 10 | - | - | - | | |
| | | 15 | | - | - | - | 5.0 | - | - | - | | |
| OFF Channel Leakage Current | | 15 | Each Channel | - | 1000 | - | ± 0.01 | 1000 | - | 3000 | nA | |
| | | | All Channels OFF | - | 1000 | - | ± 0.08 | 1000 | - | 3000 | | |

* To calculate total supply current at frequency other than 1kHz.

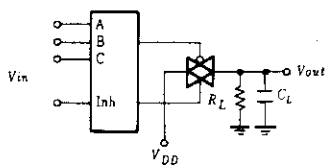
① $V_{DD}=5.0V$ $I_T=(0.07\mu A/kHz)f+I_{DD}$ ② $V_{DD}=10V$ $I_T=(0.20\mu A/kHz)f+I_{DD}$ ③ $V_{DD}=15V$ $I_T=(0.36\mu A/kHz)f+I_{DD}$

■ SWITCHING CHARACTERISTICS. ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

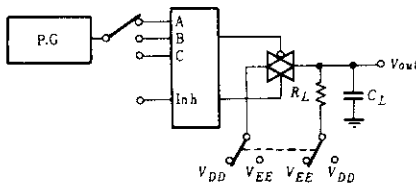
| Characteristic | Symbol | Test Conditions | | min | typ | max | Unit | | |
|---------------------------|-------------------------------|--------------------|--------------------------|---|-----|------|------|-----|----|
| | | $V_{DD}(\text{V})$ | | | | | | | |
| Propagation Delay Time | Switch Input to Switch Output | t_{PLH} | 5.0 | $R_L = 10\text{k}\Omega$ | — | 35 | 90 | ns | |
| | | | 10 | | — | 15 | 40 | | |
| | | | 15 | | — | 12 | 30 | | |
| | | | t_{PHL} | | 5.0 | — | 35 | 90 | ns |
| | | | | | 10 | — | 15 | 40 | |
| | | | | | 15 | — | 12 | 30 | |
| | Control Input to Output | t_{PLH} | 5.0 | | — | 1400 | 2000 | ns | |
| | | | 10 | | — | 450 | 700 | | |
| | | | 15 | | — | 260 | 500 | | |
| | | t_{PHL} | 5.0 | | — | 1400 | 2500 | ns | |
| | | | 10 | | — | 450 | 700 | | |
| | | | 15 | | — | 260 | 500 | | |
| Output Enable Time | t_{ZH}, t_{ZL} | 5.0 | $R_L = 10\text{k}\Omega$ | — | 850 | 2125 | ns | | |
| | | 10 | | — | 300 | 750 | | | |
| | | 15 | | — | 250 | 625 | | | |
| Output Disable Time | t_{HZ}, t_{LZ} | 5.0 | | — | 850 | 2125 | ns | | |
| | | 10 | | — | 300 | 750 | | | |
| | | 15 | | — | 250 | 625 | | | |
| Sine Wave(Distortion) | | 10 | | $R_L = 1\text{k}\Omega, f = 1\text{kHz}$ | — | 0.04 | — | % | |
| Bandwidth | BW | 10 | | $R_L = 1\text{k}\Omega, V_{iA} = \frac{1}{2}(V_{DD} - V_{SS})_{p-p}, 20\log_{10} V_{out}/V_{iA} = -3\text{dB}$ | — | 20 | — | MHz | |
| Feedthrough | | 10 | | $R_L = 1\text{k}\Omega, 20\log_{10} V_{out}/V_{iA} = -50\text{dB}$ | — | 4.5 | — | MHz | |
| Channel Separation | | 10 | | $R_L = 1\text{k}\Omega, V_{iA} = \frac{1}{2}(V_{DD} - V_{SS})_{p-p}, 20\log_{10} V_{out(A)}/V_{iA(A)} = -50\text{dB}$ | — | 3.0 | — | MHz | |
| Feedthrough Control | | 10 | | $R_L = 1\text{k}\Omega, R_L = 10\text{k}\Omega, \text{Control, Inhibit } t_i = t_f = 20\text{ns}$ | — | 30 | — | mV | |
| Maximum Control Frequency | | 10 | | $R_L = 1\text{k}\Omega, V_{out} = \frac{1}{2}V_{iA}$ | — | 10 | — | MHz | |

■ DC CHARACTERISTIC TEST CIRCUIT

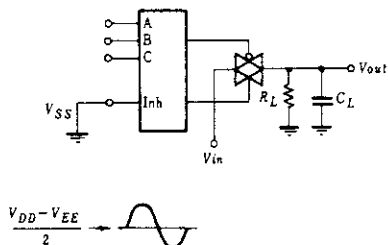
1. Input Voltage



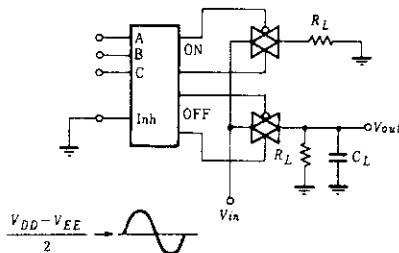
2. Propagation Delay Time



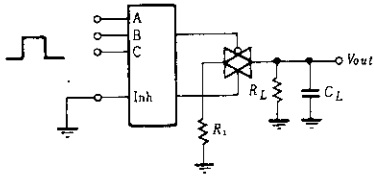
3. Bandwidth, Feedthrough



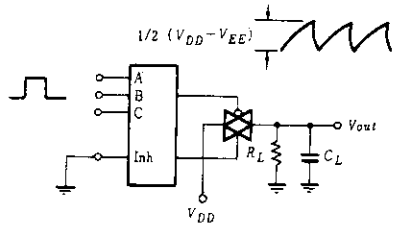
4. Crosstalk



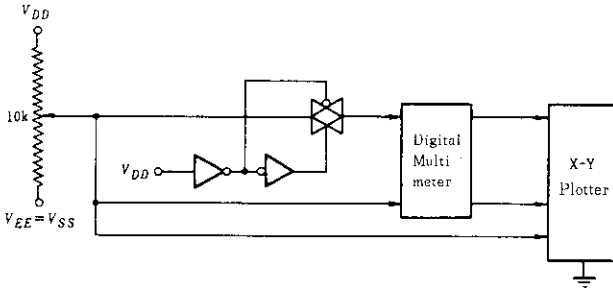
5. Feedthrough

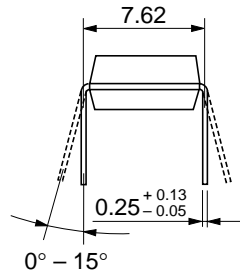
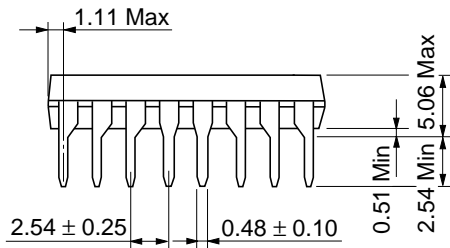
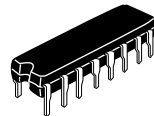
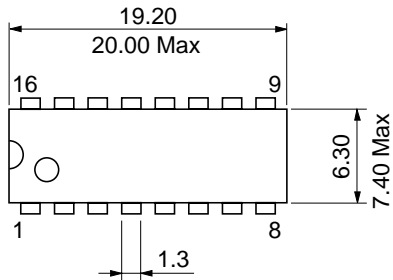


6. Maximum Control Frequency

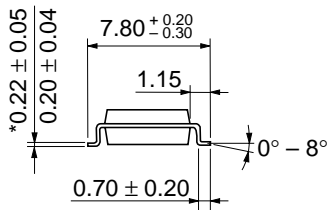
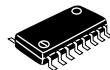
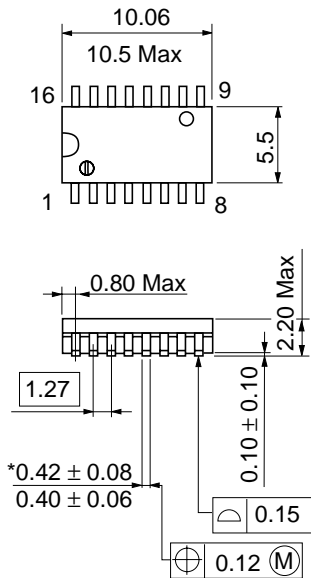


7. R_{ON}



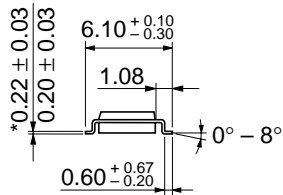
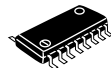
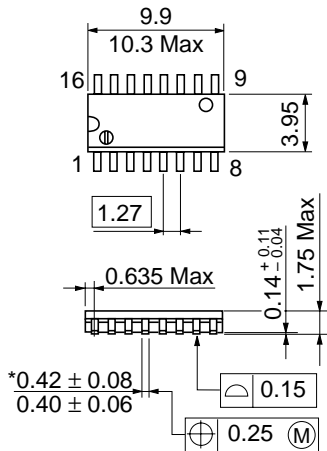


| | |
|--------------------------|----------|
| Hitachi Code | DP-16 |
| JEDEC | Conforms |
| EIAJ | Conforms |
| Weight (reference value) | 1.07 g |



*Dimension including the plating thickness
Base material dimension

| | |
|--------------------------|----------|
| Hitachi Code | FP-16DA |
| JEDEC | — |
| EIAJ | Conforms |
| Weight (reference value) | 0.24 g |



*Dimension including the plating thickness
Base material dimension

| | |
|--------------------------|----------|
| Hitachi Code | FP-16DN |
| JEDEC | Conforms |
| EIAJ | Conforms |
| Weight (reference value) | 0.15 g |

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