

DESCRIPTION

The CD4051BM96-CN analog multiplexers and demultiplexers are digitally-controlled analog switches having low ON impedance and very low OFF leakage current. These multiplexer circuits dissipate extremely low quiescent power over the full VDD-VSS and VDD-GND supply-voltage ranges, independent of the logic state of the control signals.

The CD4051BM96-CN is available in a SOP16 package.

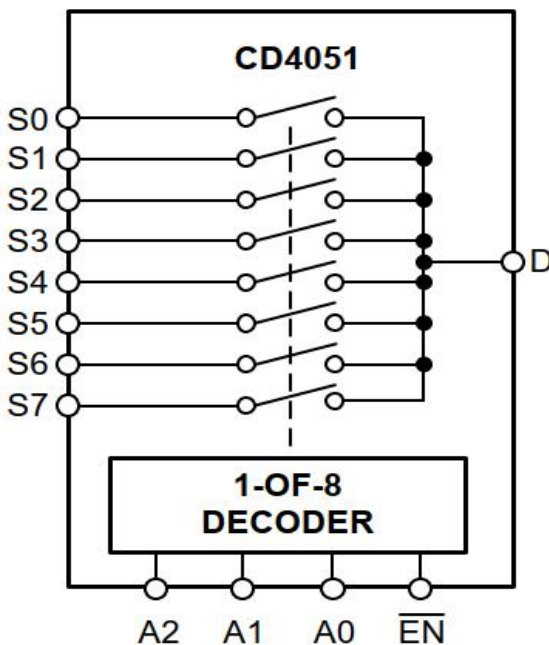
FEATURES

- Wide Supply voltage Range from 3V to15V
- Break-before-make switching

- Low on-state resistance: 55Ω (VDD-VSS=15V)
- Very low static power consumption and high off-state resistance
- Analogue switch on-resistance difference: $\Delta R_{ON}=5\Omega$ (VDD-VSS=15V)
- Built-in analogue switches control address decoder and level shifter

APPLICATIONS

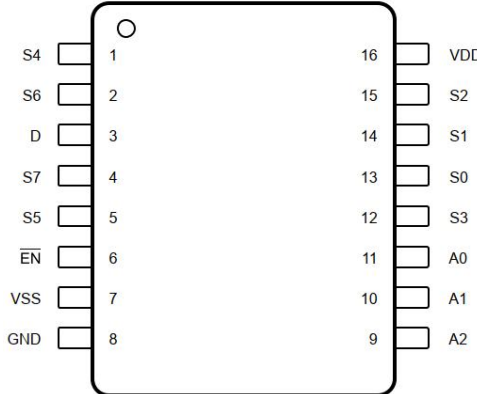
- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Factory automation and control
- Appliances
- Building automation

Simplified Schematic

Function Table

| INPUT | | | | Channel ON |
|-----------------|----|----|----|------------|
| \overline{EN} | A2 | A1 | A0 | |
| 0 | 0 | 0 | 0 | S0 to D |
| 0 | 0 | 0 | 1 | S1 to D |
| 0 | 0 | 1 | 0 | S2 to D |
| 0 | 0 | 1 | 1 | S3 to D |
| 0 | 1 | 0 | 0 | S4 to D |
| 0 | 1 | 0 | 1 | S5 to D |
| 0 | 1 | 1 | 0 | S6 to D |
| 0 | 1 | 1 | 1 | S7 to D |
| 1 | X | X | X | None |

Note: X= Don't care

Pin Configuration

| Pin No | Pin name | Description | Pin Diagram |
|--------|-----------------|-----------------------------|--|
| 1 | S4 | independent input or output |  |
| 2 | S6 | independent input or output | |
| 3 | D | common output or input | |
| 4 | S7 | independent input or output | |
| 5 | S5 | independent input or output | |
| 6 | \overline{EN} | enable input(active low) | |
| 7 | VSS | supply voltage | |
| 8 | GND | ground | |
| 9 | A2 | select input | |
| 10 | A1 | select input | |
| 11 | A0 | select input | |
| 12 | S3 | independent input or output | |
| 13 | S0 | independent input or output | |
| 14 | S1 | independent input or output | |
| 15 | S2 | independent input or output | |
| 16 | VDD | supply voltage | |

Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | MIN | MAX | UNIT |
|------------------------------------|-----|--------------|------|
| Supply Voltage | | 18 | V |
| Input voltage | | $V_{DD}+0.5$ | V |
| Input current | | ± 10 | mA |
| Maximum Junction Temperature | | +150 | °C |
| Storage Temperature Range | -65 | +150 | °C |
| Lead Temperature(soldering, 10sec) | | +260 | °C |

Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | MIN | TYP | MAX | UNIT |
|-----------------------------|-----|-----|----------|------|
| Supply Voltage | 3 | | 15 | V |
| Input voltage | 0 | | V_{DD} | V |
| Operating Temperature Range | -20 | +25 | +85 | °C |

Electrical Characteristics

 (At $T_A=+25^{\circ}\text{C}$, $V_{SS}=0\text{V}$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|-----------------|--|---------------------|-----|------------|-----------|---------------|
| Supply Current | I_{DD} | $V_{DD}=5\text{V}$ | | 0 | - | 20 | μA |
| | | $V_{DD}=10\text{V}$ | | 0 | - | 40 | |
| | | $V_{DD}=15\text{V}$ | | 0 | - | 80 | |
| ON resistance | R_{ON} | $V_{DD}=2.5\text{V}, V_{SS}=-2.5\text{V},$ or $V_{DD}=5\text{V}, V_{SS}=0\text{V}$ | | - | 180 | 1050 | Ω |
| | | $V_{DD}=5\text{V}, V_{SS}=-5\text{V},$ or $V_{DD}=10\text{V}, V_{SS}=0\text{V}$ | | - | 70 | 400 | |
| | | $V_{DD}=7.5\text{V}, V_{SS}=-7.5\text{V},$ or $V_{DD}=15\text{V}, V_{SS}=0\text{V}$ | | - | 55 | 240 | |
| ON resistance mismatch between channels | ΔR_{on} | $V_{DD}=2.5\text{V}, V_{SS}=-2.5\text{V},$ or $V_{DD}=5\text{V}, V_{SS}=0\text{V}$ | | - | 10 | - | Ω |
| | | $V_{DD}=5\text{V}, V_{SS}=-5\text{V},$ or $V_{DD}=10\text{V}, V_{SS}=0\text{V}$ | | - | 10 | - | |
| | | $V_{DD}=7.5\text{V}, V_{SS}=-7.5\text{V},$ or $V_{DD}=15\text{V}, V_{SS}=0\text{V}$ | | - | 5 | - | |
| OFF Channel Leakage Current Any Channel OFF | I_{OFF} | $V_{DD}=7.5\text{V}, V_{SS}=-7.5\text{V},$ $O/I=\pm 7.5\text{V}, I/O=0\text{V}$ | | - | ± 0.01 | ± 50 | nA |
| OFF Channel Leakage Current ALL Channels OFF | | $\overline{\text{EN}}=7.5\text{V}$ | | - | ± 0.04 | ± 200 | nA |
| Input Low Voltage | V_{IL} | $ I_O < 1\mu\text{A}$ | $V_{DD}=5\text{V}$ | - | - | 1.5 | V |
| | | | $V_{DD}=10\text{V}$ | - | - | 3.0 | |
| | | | $V_{DD}=15\text{V}$ | - | - | 4.0 | |
| Input High Voltage | V_{IH} | $ I_O < 1\mu\text{A}$ | $V_{DD}=5\text{V}$ | 3.5 | - | - | V |
| | | | $V_{DD}=10\text{V}$ | 7 | - | - | |
| | | | $V_{DD}=15\text{V}$ | 11 | - | - | |
| Input current | I_{IN} | $V_{IN}=0\text{V}$ | $V_{DD}=15\text{V}$ | - | -10^{-5} | -0.3 | μA |
| | | $V_{IN}=15\text{V}$ | | - | 10^{-5} | 0.3 | |

AC Performance Characteristics

 (At $T_A=+25^{\circ}\text{C}$, $V_{SS}=0\text{V}$, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNIT |
|--|------------------------|--|---------------------|-----|-----|------|-------------|
| Propagation Delay Time (open channel) | t_{PZH} t_{PZL} | $R_L=1\text{K}\Omega, C_L=50\text{pF}$ | $V_{DD}=5\text{V}$ | - | - | 1200 | ns |
| | | | $V_{DD}=10\text{V}$ | - | - | 450 | |
| | | | $V_{DD}=15\text{V}$ | - | - | 320 | |
| Propagation Delay Time (off channel) | t_{PHZ} t_{PLZ} | $R_L=1\text{K}\Omega, C_L=50\text{pF}$ | $V_{DD}=5\text{V}$ | - | - | 420 | ns |
| | | | $V_{DD}=10\text{V}$ | - | - | 200 | |
| | | | $V_{DD}=15\text{V}$ | - | - | 150 | |

| | | | | | | | |
|--|------------------------|---|--------------|---|------|------|-----|
| Input capacitance | C_{IN} | - | $V_{DD}=10V$ | - | - | 7.5 | pF |
| Output capacitance | C_{out} | - | $V_{DD}=10V$ | - | 15 | - | pF |
| Bypass Capacitors | C_{IOS} | - | $V_{DD}=10V$ | - | 0.2 | - | pF |
| Power Dissipation Capacitors | C_{PO} | - | $V_{DD}=10V$ | - | 140 | - | pF |
| Sine Wave Distortion | | $R_L=10K\Omega, f_{IS}=1KHz,$ $V_{IS}=5V_{pp}, V_{SI}=0V$ | $V_{DD}=10V$ | - | 0.04 | - | % |
| Sine Wave Frequency Response | | $R_L=1K\Omega, V_{IS}=5V_{pp},$ $20\log_{10}(V_{OS}/V_{IS})=-40dB$ | $V_{DD}=10V$ | - | 40 | - | MHz |
| Off-state Crosstalk Frequency | | $R_L=1K\Omega, V_{IS}=5V_{pp},$ $20\log_{10}(V_{OS}/V_{IS})=-40dB$ | $V_{DD}=10V$ | - | 10 | - | MHz |
| Signal Crosstalk Frequency | | $R_L=1K\Omega, V_{IS}=5V_{pp},$ $20\log_{10}(V_{OS}/V_{IS})=-40dB$ | $V_{DD}=10V$ | - | 3 | - | MHz |
| Signal input to output Propagation Delay | t_{PHL} t_{PLH} | $C_L=50pF$ | $V_{DD}=5V$ | - | 25 | 55 | ns |
| | | | $V_{DD}=10V$ | - | 15 | 35 | |
| | | | $V_{DD}=15V$ | - | 10 | 25 | |
| Control input to signal response | | $R_L=10K\Omega$ | $V_{DD}=10V$ | - | 65 | - | ns |
| Propagation delay time From addressing to signal output Channel is on or off | t_{PHL} t_{PLH} | $C_L=50pF$ | $V_{DD}=5V$ | - | 300 | 1000 | ns |
| | | | $V_{DD}=10V$ | - | 100 | 350 | |
| | | | $V_{DD}=15V$ | - | 70 | 240 | |

Parameter Measurement Information

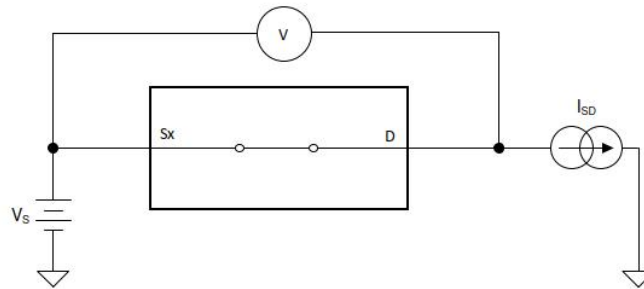


Figure 1. On-Resistance Measurement Setup

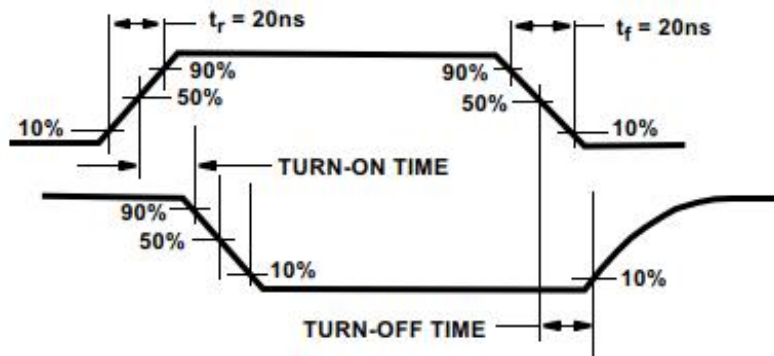


Figure 2. Waveforms, Channel Being Turned ON($R_L = 1 k\Omega$)

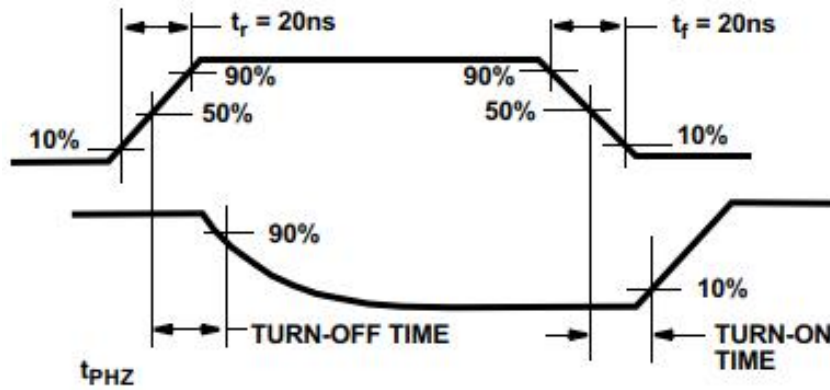


Figure 3. Waveforms, Channel Being Turned OFF(RL = 1 kΩ)

Typical Application

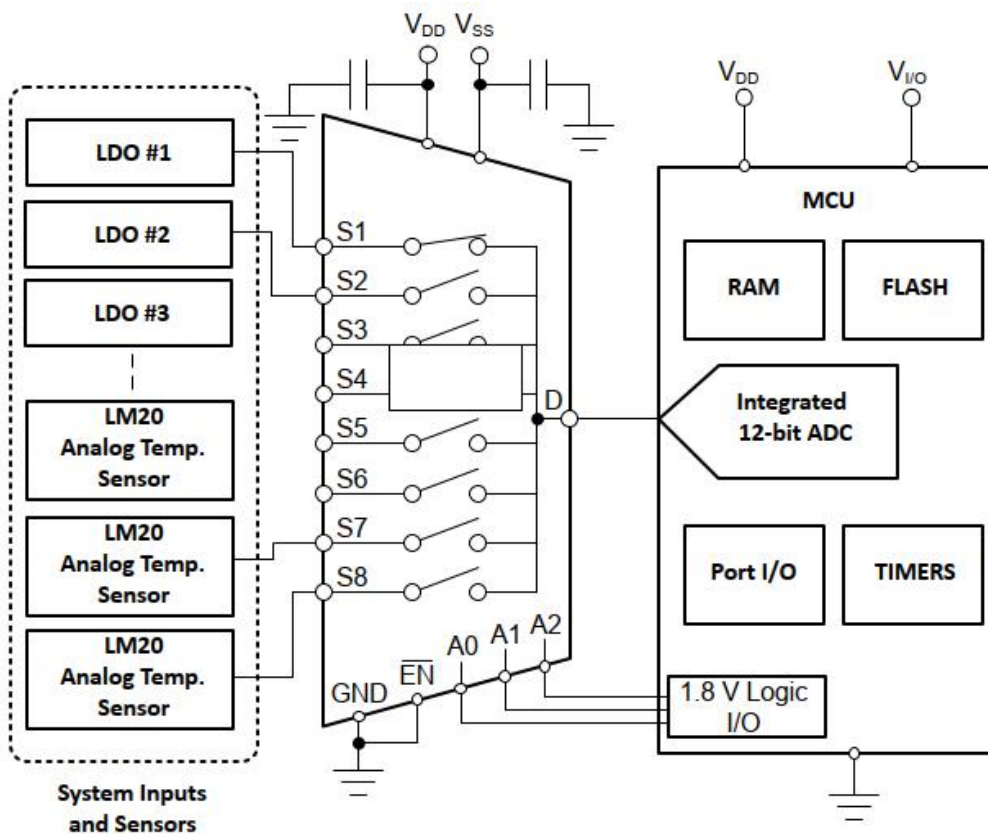
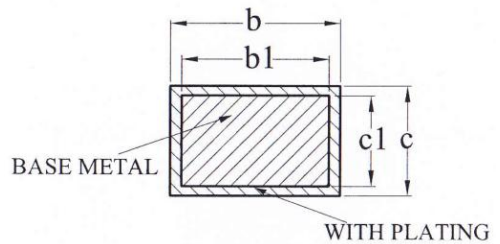
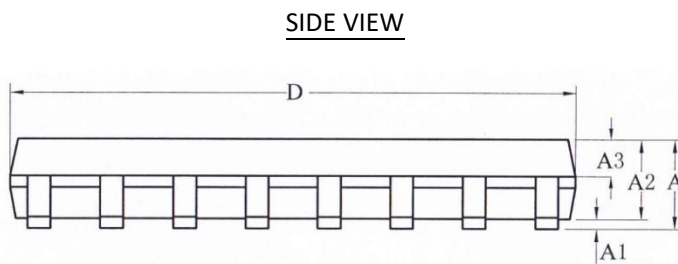
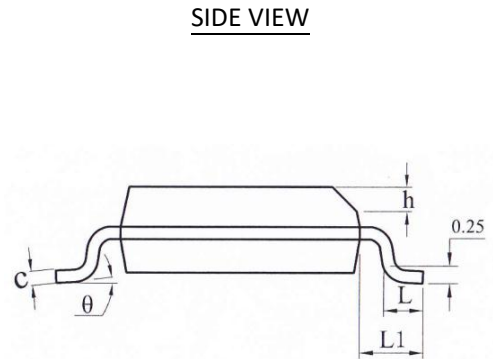
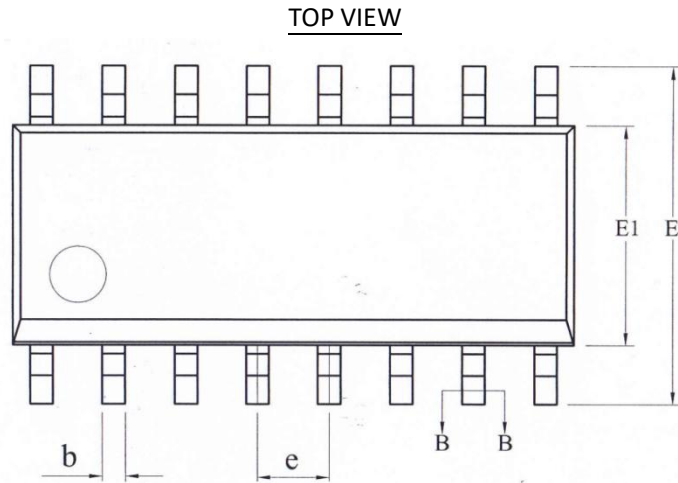


Figure 4. Multiplexing Signals to an Integrated ADC with CD4051

PACKAGE OUTLINE DIMENSIONS
SOP16


| SYMBOL | MILLIMETER | | | SYMBOL | MILLIMETER | | |
|--------|------------|------|-------|----------|------------|------|-------|
| | MIN | MIN | MIN | | MIN | NOM | MAX |
| A | - | - | 1.75 | D | 9.80 | 9.90 | 10.00 |
| A1 | 0.10 | - | 0.225 | E | 5.80 | 6.00 | 6.20 |
| A2 | 1.30 | 1.45 | 1.50 | E1 | 3.80 | 3.90 | 4.00 |
| A3 | 0.60 | 0.65 | 0.70 | e | 1.27 (BSC) | | |
| b | 0.39 | - | 0.47 | H | 0.25 | - | 0.50 |
| b1 | 0.38 | 0.41 | 0.44 | L | 0.50 | - | 0.80 |
| c | 0.20 | - | 0.24 | L1 | 1.05 (REF) | | |
| c1 | 0.19 | 0.20 | 0.21 | θ | 0° | - | 8° |

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