



## CMOS Single 8-Channel Analog Multiplexer/Demultiplexer

### 1 Features

- ◆ High bandwidth: 390 MHz
- ◆ High off-Isolation: -84dB( $R_L=50\ \Omega$ ,  $f=1\ \text{MHz}$ )
- ◆ Supply range: +2.5 V to +5.5 V
- ◆ Low on-state resistance:  $22\ \Omega$  @4.5V
- ◆ Break-before-make switching
- ◆ Binary address decoding on chip
- ◆ Operation temperature range:  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$
- ◆ Micro size packages: TSSOP16

### 2 Application

- ◆ Sensors
- ◆ Analog and digital multiplexing and demultiplexing
- ◆ A/D and D/A conversion
- ◆ Signal gating
- ◆ Battery-operated equipment
- ◆ Factory automation
- ◆ Communications circuits
- ◆ Appliances

### 3 Description

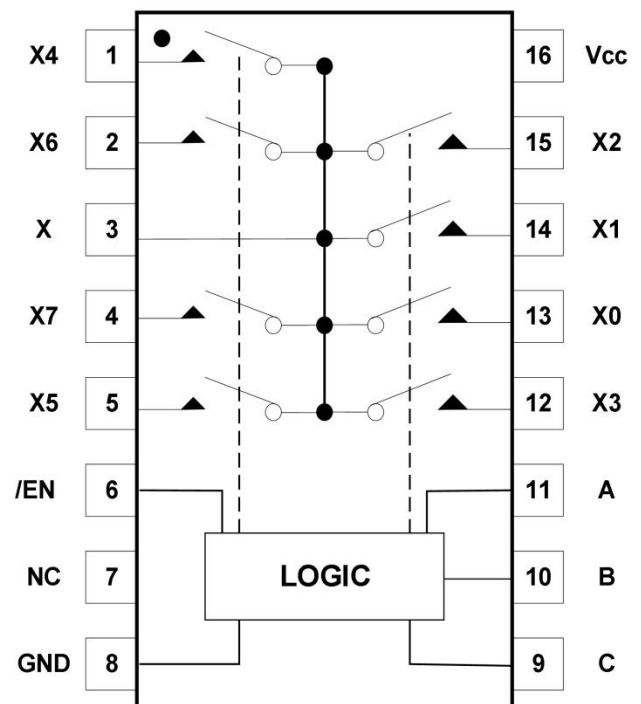
The WB4851 is a CMOS analog IC configured as an 8-channel multiplexer. This CMOS device can operate from 2.5 V to 5.5 V.

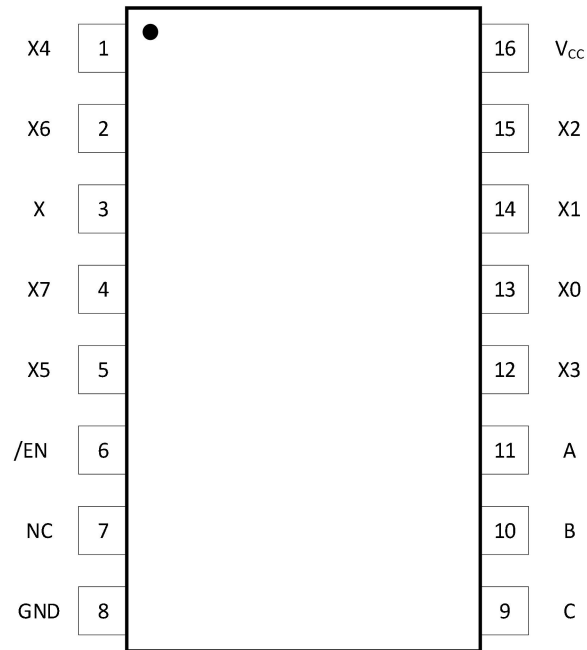
The WB4851 device are digitally controlled analog switches. It has low on-resistance

( $22\ \Omega$  TYP) and very low off-leakage current (1 nA TYP).

The WB4851 is available in Green TSSOP16 packages. It operates over an ambient temperature range of  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ .

### 4 Circuit diagram



**5 Device Pin and Packages****Table 5-1 Pin definition**

| Name            | Pin                        | Description                                      |
|-----------------|----------------------------|--------------------------------------------------|
| X0-X7           | 13, 14, 15, 12, 1, 5, 2, 4 | Analog Switch Inputs X0-X7                       |
| X               | 3                          | Analog Switch “X” Output.                        |
| V <sub>CC</sub> | 16                         | Power Supply                                     |
| A               | 11                         | Digital Address “A” Input.                       |
| B               | 10                         | Digital Address “B” Input.                       |
| C               | 9                          | Digital Address “C” Input.                       |
| GND             | 8                          | Ground                                           |
| NC              | 7                          | No Connect.                                      |
| /EN             | 6                          | Digital Enable Input. Normally connected to GND. |
| EP              | -                          | Exposed Pad. Connect EP to GND.                  |

**5 Device Pin and Packages(Continued)****Table 5-2 Function Table**

| /EN Input | Input Status |   |   | ON Channel(s) |
|-----------|--------------|---|---|---------------|
|           | C            | B | A |               |
| 1         | X            | X | X | NONE          |
| 0         | 0            | 0 | 0 | X-X0          |
| 0         | 0            | 0 | 1 | X-X1          |
| 0         | 0            | 1 | 0 | X-X2          |
| 0         | 0            | 1 | 1 | X-X3          |
| 0         | 1            | 0 | 0 | X-X4          |
| 0         | 1            | 0 | 1 | X-X5          |
| 0         | 1            | 1 | 0 | X-X6          |
| 0         | 1            | 1 | 1 | X-X7          |

X=Don't care

NOTE: Input and output pins are identical and interchangeable. Either may be considered an input or output; signals pass equally well in either direction.



## 6 Voltage, Temperature, ESD and Thermal Ratings

### 6.1 Absolute Maximum Ratings<sup>(1)</sup>

| Parameters |                                          | Min. | Max.           | Unit |
|------------|------------------------------------------|------|----------------|------|
| $V_{CC}$   | Supply voltage range                     | -0.3 | 6.0            | V    |
| $V_{IN}$   | Input voltage(All inputs) <sup>(2)</sup> | -0.3 | $(V_{CC})+0.3$ | V    |
| $I_{IN}$   | Switch input current                     | -20  | +20            | mA   |
| $I_{PEAK}$ | Peak switch current                      | -40  | +40            | mA   |
| $T_J$      | Junction temperature under bias          |      | 150            | °C   |
| $T_{stg}$  | Storage temperature range                | -65  | 150            | °C   |

(1)Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2)The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

### 6.2 ESD Ratings

| ESD    |                         |                                           | Value | Unit |
|--------|-------------------------|-------------------------------------------|-------|------|
| V(ESD) | Electrostatic discharge | Human-Body Model (HBM) <sup>(1)</sup>     | 6K    | V    |
|        |                         | Charged-Device Model (CDM) <sup>(2)</sup> | 2K    | V    |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions<sup>(1)</sup>

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

| Symbol   | Parameter           | Min | Max | Units |
|----------|---------------------|-----|-----|-------|
| $V_{CC}$ | Supply voltage      | 2.5 | 5.5 | V     |
| $T_A$    | Ambient temperature | -40 | 125 | °C    |

(1) All unused digital inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

### 6.4 Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|--------------|---------------|---------------|------|
| TSSOP16      | 111.3         | 45.3          | °C/W |



## 7 Electrical Specifications

### 7.1 DC Electrical Characteristics

$V_{CC}=2.5V$  to  $5.5V$ , FULL= $-40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $T_A=+25^{\circ}C$  (unless otherwise noted)

| Parameter                            | Symbol                                                                  | Conditions                                                        | V+           | Temp  | Min | Typ | Max             | Units |
|--------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------|--------------|-------|-----|-----|-----------------|-------|
| Analog Switch                        |                                                                         |                                                                   |              |       |     |     |                 |       |
| Analog Signal Range                  | V <sub>x</sub> , V <sub>x</sub>                                         |                                                                   |              |       | 0   |     | V <sub>CC</sub> | V     |
| On-Resistance                        | R <sub>ON</sub>                                                         | I <sub>x</sub> =10mA                                              | 4.5V         | +25°C |     | 22  | 25              | Ω     |
|                                      |                                                                         |                                                                   |              | Full  |     |     | 30              | Ω     |
|                                      |                                                                         |                                                                   | 3V           | +25°C |     | 50  | 55              | Ω     |
|                                      |                                                                         |                                                                   |              | Full  |     |     | 60              | Ω     |
| On-Resistance Match Between Channels | ΔR <sub>ON</sub>                                                        | I <sub>x</sub> =10mA                                              | 4.5V         | +25°C |     | 0.3 | 0.5             | Ω     |
|                                      |                                                                         |                                                                   |              | Full  |     |     | 0.8             | Ω     |
|                                      |                                                                         |                                                                   | 3V           | +25°C |     | 0.5 | 1               | Ω     |
|                                      |                                                                         |                                                                   |              | Full  |     |     | 1.5             | Ω     |
| On-Resistance Flatness               | R <sub>FLAT(ON)</sub>                                                   | I <sub>x</sub> =10mA                                              | 4.5V         | +25°C |     | 7   | 10              | Ω     |
|                                      |                                                                         |                                                                   |              | Full  |     |     | 12              | Ω     |
|                                      |                                                                         |                                                                   | 3V           | +25°C |     | 30  | 33              | Ω     |
|                                      |                                                                         |                                                                   |              | Full  |     |     | 35              | Ω     |
| X,X_ Off,X_ On Leakage Current       | I <sub>X_(OFF)</sub> , I <sub>X(OFF)</sub> ,<br>I <sub>X(ON)</sub> ,    | V <sub>X</sub> =0V,4.5V,V <sub>X</sub> =4.5V,0V                   | 5.5V         | +25°C |     | 1   | 1000            | nA    |
|                                      |                                                                         | V <sub>X</sub> =1V,3V,V <sub>X</sub> =1V,3V                       | 3.6V         | +25°C |     | 1   | 1000            | nA    |
| Digital Control Input                |                                                                         |                                                                   |              |       |     |     |                 |       |
| Logic Input Logic Threshold High     | V <sub>AH</sub> ,V <sub>BH</sub> ,V <sub>CH</sub> ,<br>V <sub>/EN</sub> |                                                                   | 5V           | +25°C | 1.6 |     |                 | V     |
|                                      |                                                                         |                                                                   | 3.3V         |       | 1.2 |     |                 | V     |
| Logic Input Logic Threshold Low      | V <sub>AL</sub> ,V <sub>BL</sub> ,V <sub>CL</sub> ,<br>V <sub>/EN</sub> |                                                                   | 5V           | +25°C |     |     | 0.7             | V     |
|                                      |                                                                         |                                                                   | 3.3V         |       |     |     | 0.5             | V     |
| Input-Current High                   | I <sub>AH</sub> ,I <sub>BH</sub> ,I <sub>CH</sub> ,<br>I <sub>/EN</sub> | V <sub>A</sub> ,V <sub>B</sub> ,V <sub>/EN</sub> =V <sub>CC</sub> | 3.6V to 5.5V | +25°C |     | 1   | 1000            | nA    |
| Input-Current Low                    | I <sub>AL</sub> ,I <sub>BL</sub> ,I <sub>CL</sub> ,<br>I <sub>/EN</sub> | V <sub>A</sub> ,V <sub>B</sub> ,V <sub>/EN</sub> =0V              | 3.6V to 5.5V | +25°C |     | 1   | 1000            | nA    |

(1) All unused digital inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

**7.2 Switch And AC Characteristics**

$V_{CC}=2.5V$  to  $5.5V$ , FULL= $-40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $T_A=+25^{\circ}C$  (unless otherwise noted)

| Parameter                    | Symbol       | Conditions                                         | V+   | Temp           | Min | Typ | Max | Units   |
|------------------------------|--------------|----------------------------------------------------|------|----------------|-----|-----|-----|---------|
| Address Transition Time      | $t_{TRANS}$  | $V_{X\_}=3V/0V$ , $R_L=300\Omega$ , $C_L=35pF$     | 5V   | $+25^{\circ}C$ |     | 34  |     | ns      |
|                              |              | $V_{X\_}=3V/0V$ , $R_L=300\Omega$ , $C_L=35pF$     | 3.3V |                |     | 75  |     | ns      |
| Turn-On Time                 | $t_{ON}$     | $V_{X\_}=3V$ , $R_L=300\Omega$ , $C_L=35pF$        | 5V   | $+25^{\circ}C$ |     | 30  |     | ns      |
|                              |              |                                                    | 3.3V |                |     | 72  |     | ns      |
| Turn-Off Time                | $t_{OFF}$    | $V_{X\_}=3V$ , $R_L=300\Omega$ , $C_L=35pF$        | 5V   | $+25^{\circ}C$ |     | 5   |     | ns      |
|                              |              |                                                    | 3.3V |                |     | 7   |     | ns      |
| Input Transition RiseTime    | $t_R$        | $V_{X\_}=3V$ , $R_L=300\Omega$ , $C_L=35pF$        | 5V   | $+25^{\circ}C$ |     | 8   |     | ns      |
|                              |              |                                                    | 3.3V |                |     | 41  |     | ns      |
| Input Transition Fall Time   | $t_F$        | $V_{X\_}=3V$ , $R_L=300\Omega$ , $C_L=35pF$        | 5V   | $+25^{\circ}C$ |     | 42  |     | ns      |
|                              |              |                                                    | 3.3V |                |     | 42  |     | ns      |
| Break-Before-Make Time Delay | $t_D$        | $V_{X\_}=3V$ , $R_L=300\Omega$ , $C_L=35pF$        | 5V   | $+25^{\circ}C$ |     | 11  |     | ns      |
|                              |              |                                                    | 3.3V |                |     | 29  |     | ns      |
| Charge Injection             | Q            | $R_S=0\Omega$ , $C_L=1nF$                          | 5V   | $+25^{\circ}C$ |     | 10  |     | pC      |
|                              |              | $R_S=0\Omega$ , $C_L=1nF$                          | 3.3V |                |     | 7   |     | pC      |
| Off Isolation                | $O_{ISO}$    | $R_L=50\Omega$ , $f=1MHz$                          | 5V   | $+25^{\circ}C$ |     | -84 |     | dB      |
|                              |              | $R_L=50\Omega$ , $f=1MHz$                          | 3.3V | $+25^{\circ}C$ |     | -84 |     | dB      |
| -3dB Bandwidth               | BW           | $R_L=50\Omega$                                     | 5V   | $+25^{\circ}C$ |     | 390 |     | MHZ     |
|                              |              |                                                    | 3.3V |                |     | 370 |     | MHZ     |
| Input Off-Capacitance        | $C_{X(OFF)}$ | $V_{X\_}=0V$ , $f=1MHz$                            | 5V   | $+25^{\circ}C$ |     | 10  |     | pF      |
| Output Off-Capacitance       | $C_{X(OFF)}$ | $V_{X\_}=0V$ , $f=1MHz$                            | 5V   | $+25^{\circ}C$ |     | 6   |     | pF      |
| Output On-Capacitance        | $C_{X(ON)}$  | $V_{X\_}=0V$ , $f=1MHz$                            | 5V   | $+25^{\circ}C$ |     | 3   |     | pF      |
| Total Harmonic Distortion    | THD          | $R_L=600\Omega$ , $5V_{P-P}$ , $f=20Hz$ to $20kHz$ | 5V   | $+25^{\circ}C$ |     | 0.1 |     | %       |
| Power Supply Range           | $V_{CC}$     |                                                    |      | Full           | 2.5 |     | 5.5 | V       |
| Power Supply Current         | $I_{CC}$     | $V_A, V_B, V_C, V_{/EN}=V_{CC}$ or 0               | 5V   | $+25^{\circ}C$ |     | 1   | 6   | $\mu A$ |
|                              |              | $V_A, V_B, V_C, V_{/EN}=V_{CC}$ or 0               | 3.3V |                |     | 1   | 3   | $\mu A$ |



## 8 Typical Characteristics

$V_{CC}=2.5V$  to  $5.5V$ , FULL= $-40^{\circ}C$  to  $+125^{\circ}C$ . Typical values are at  $T_A=+25^{\circ}C$  (unless otherwise noted)

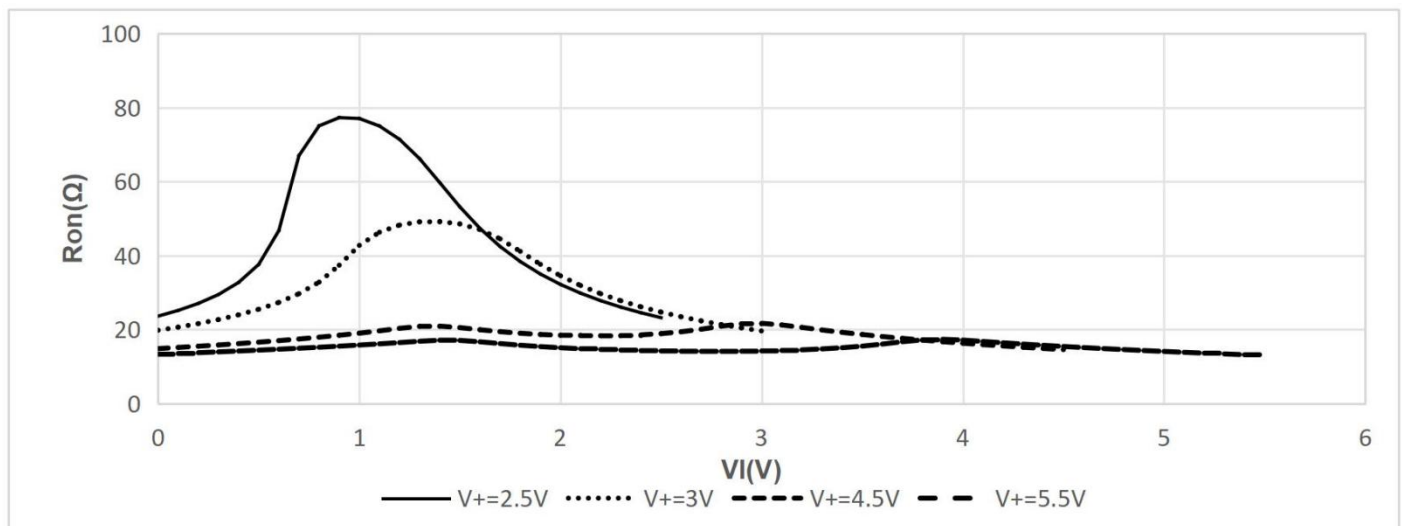


Fig.8-1.  $R_{on}$  VS Input Voltage



## 9 Measurement Information

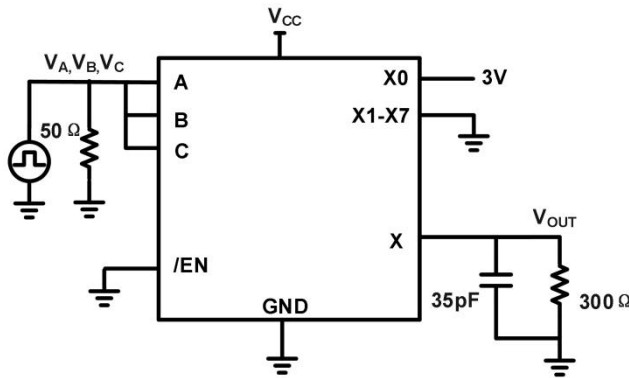


Fig.9-1.Address Transition Times ( $t_{TRANS}$ )

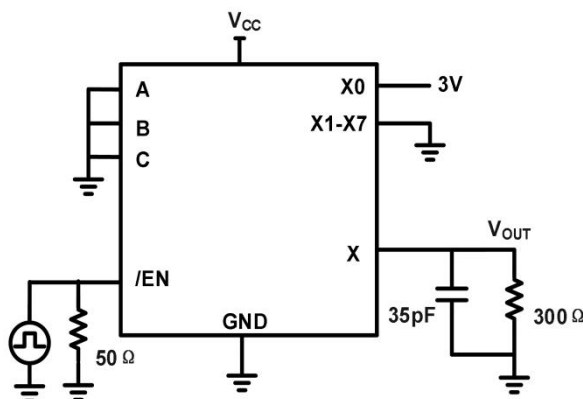
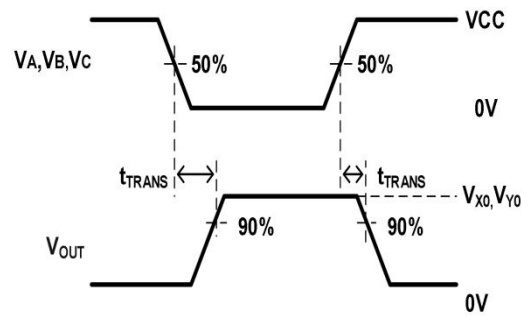


Fig.9-2. Switching Times ( $t_{ON}, t_{OFF}$ )

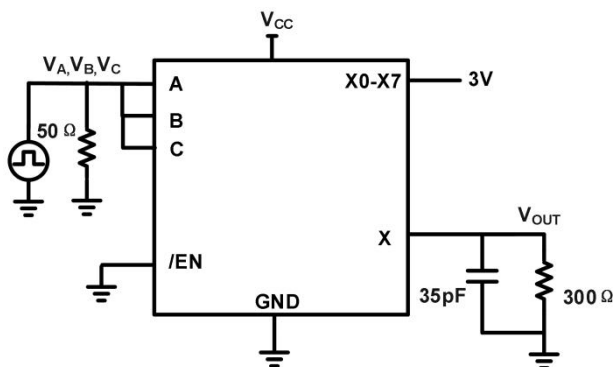
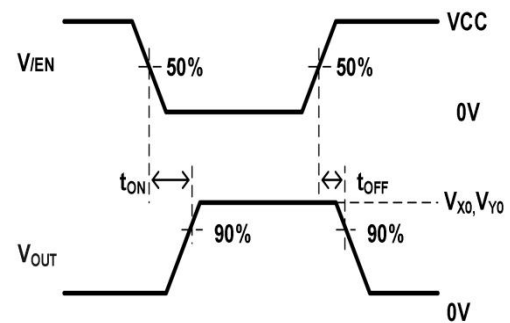
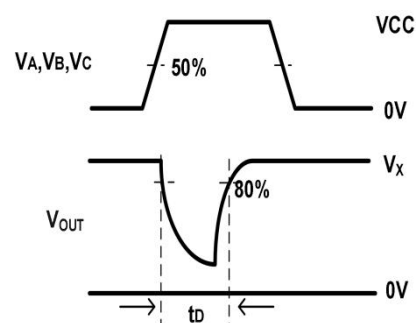
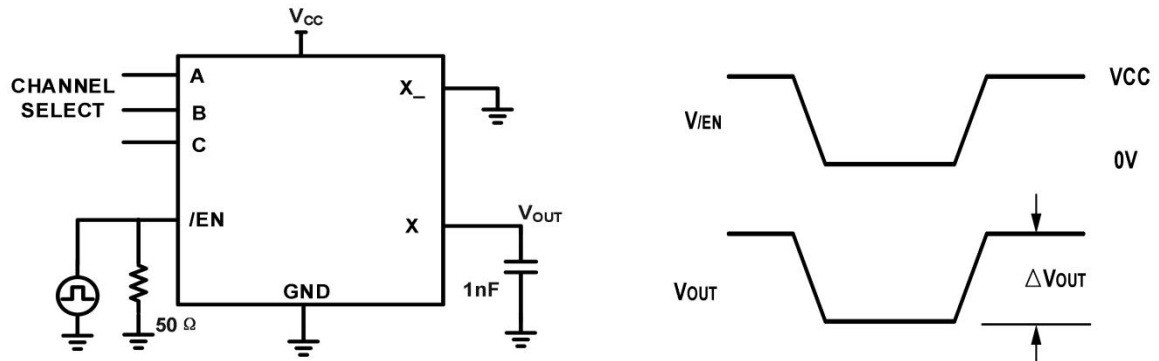


Fig.9-3. Break-Before-Make Time Delay ( $t_D$ )





## 9 Measurement Information(Continued)



$$Q = \Delta V_{OUT} \times C_L$$

Fig.9-4. Charge Injection (Q)

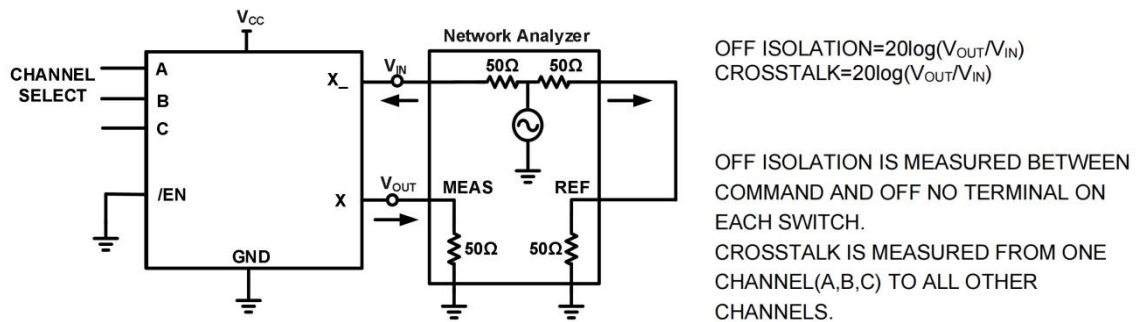


Fig.9-5. OFF Isolation

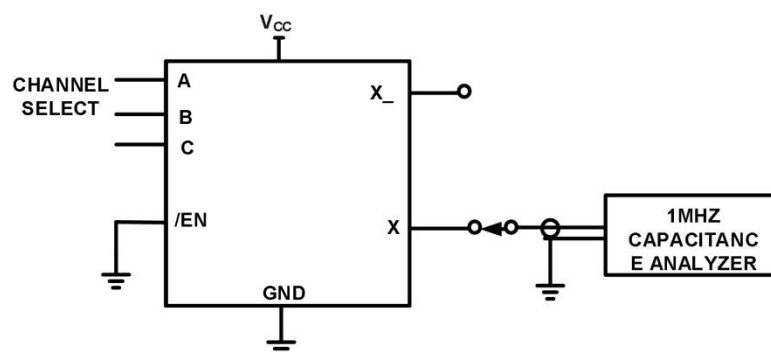


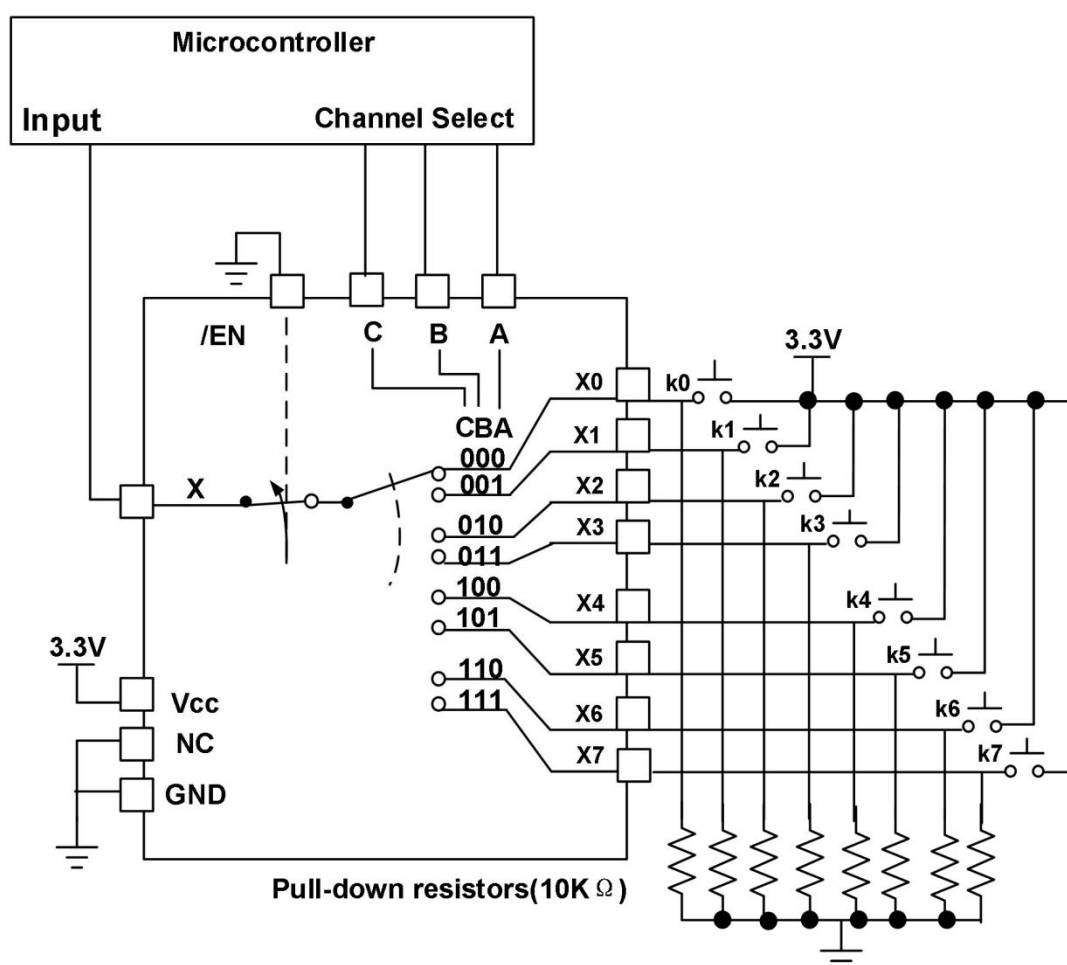
Fig.9-6. Capacitance



## CMOS Single 8-Channel Analog Multiplexer/Demultiplexer

The WB4851 device is a single 8-channel multiplexer having three binary control inputs, A, B, and C, and an inhibit input. The three binary signals select 1 of 8 channels to be turned on and connect one of the 8 inputs to the output.

One application of the WB4851 is to use it in conjunction with a microcontroller to poll a keypad. Fig.10-1 shows the basic schematic for such a polling system. The microcontroller uses the channel select pins to cycle through the different channels while reading the input to see if a user is pressing any of the keys. This is a very robust setup, allowing for multiple simultaneous key-presses with very little power consumption. It also utilizes very few pins on the microcontroller. The down side of polling is that the microcontroller must continually scan the keys for a press and can do little else during this process.





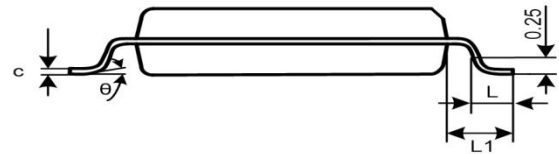
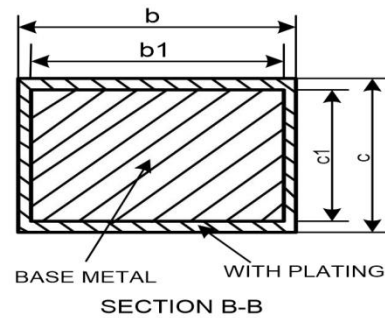
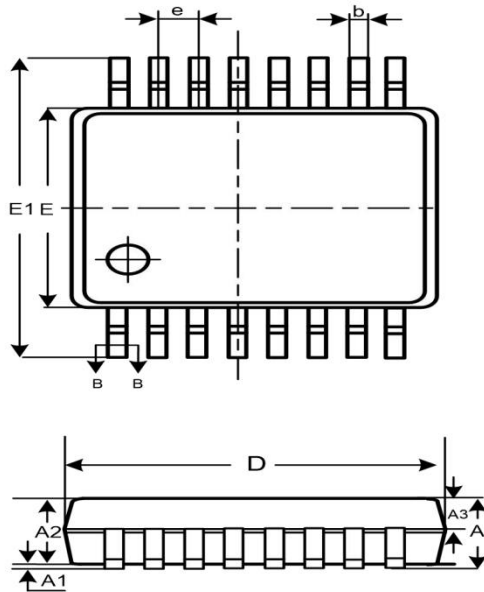
waferbest

WB4851

CMOS Single 8-Channel Analog Multiplexer/Demultiplexer

## 11 Package Outline Dimension

TSSOP-16



| Symbol | Dimensions In Millimeters |      |      | Dimensions In Inches |       |       |
|--------|---------------------------|------|------|----------------------|-------|-------|
|        | Min                       | Nom  | Min  | Nom                  | Min   | Nom   |
| A      | —                         | —    | 1.20 | —                    | —     | 0.047 |
| A1     | 0.05                      | —    | 0.15 | 0.002                | —     | 0.006 |
| A2     | 0.80                      | 1.00 | 1.05 | 0.031                | 0.039 | 0.041 |
| A3     | 0.39                      | 0.44 | 0.49 | 0.015                | 0.017 | 0.019 |
| b      | 0.19                      | —    | 0.30 | 0.007                | —     | 0.012 |
| b1     | 0.19                      | 0.22 | 0.25 | 0.007                | 0.009 | 0.010 |
| c      | 0.13                      | —    | 0.18 | 0.005                | —     | 0.007 |
| c1     | 0.12                      | 0.13 | 0.14 | 0.005                | 0.005 | 0.006 |
| D      | 4.86                      | 4.98 | 5.10 | 0.191                | 0.196 | 0.201 |
| E      | 4.30                      | 4.40 | 4.50 | 0.169                | 0.173 | 0.177 |
| E1     | 6.20                      | 6.40 | 6.60 | 0.244                | 0.252 | 0.260 |
| e      | 0.65BSC                   |      |      | 0.026BSC             |       |       |
| L      | 0.45                      | 0.60 | 0.75 | 0.018                | 0.024 | 0.030 |
| L1     | 1.00BSC                   |      |      | 0.039BSC             |       |       |
| θ      | 0°                        | —    | 8°   | 0°                   | —     | 8°    |



**waferbest**

**WB4851**

**CMOS Single 8-Channel Analog Multiplexer/Demultiplexer**

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**Notes For Attention**

- When making the purchase, please ensure you recognize the company's trademark. If you have any questions, please contact the company's headquarters.
- When designing the circuit, please do not exceed the absolute maximum ratings of the components; otherwise, it will affect the reliability of the entire machine.
- This manual may be subject to changes in version without further notice.
- WaferBest assumes no obligation for application assistance or customer product design. The provided design solutions and materials are for reference only. Customers are responsible for the use of our products and applications by themselves. To minimize risks related to customer products and applications, customers should conduct thorough design verification, small-scale trial production, large-scale trial production, and operational safety measures.