



## 3.3V 26-Channel, Three-Stateable Transmission Gate

**DS3690**

### General Description

The DS3690 is a 26-channel, three-stateable transmission gate designed for transparent digital signal transfer when enabled and fast-gated bus isolation when the device is disabled. Each of the 26 independent channels can be used for input, output, or I/O signal applications, with a typical signal propagation delay of less than 10ns. Using the logic-control input, all channels can be simultaneously enabled for bus transmission or forced to a high-impedance condition to isolate a critical component on that bus.

The DS3690 operates on a single 3.3V (typical) power supply and is available in a space-saving 56-pin lead-free TQFN package.

### Features

- ◆ 26 Bidirectional Channels
- ◆ Low Propagation Delay (< 10ns typ)
- ◆ High-Speed On/Off Time (< 20ns typ)
- ◆ 2.7V to 3.6V Supply
- ◆ Wide Temperature Range: -55°C to +85°C
- ◆ TQFN Package (5mm x 11mm x 0.8mm)

### Applications

POS Terminals  
PIN Pads  
Cryptographic Processors  
Gaming  
Lottery Terminals  
Industrial Controls and Monitoring

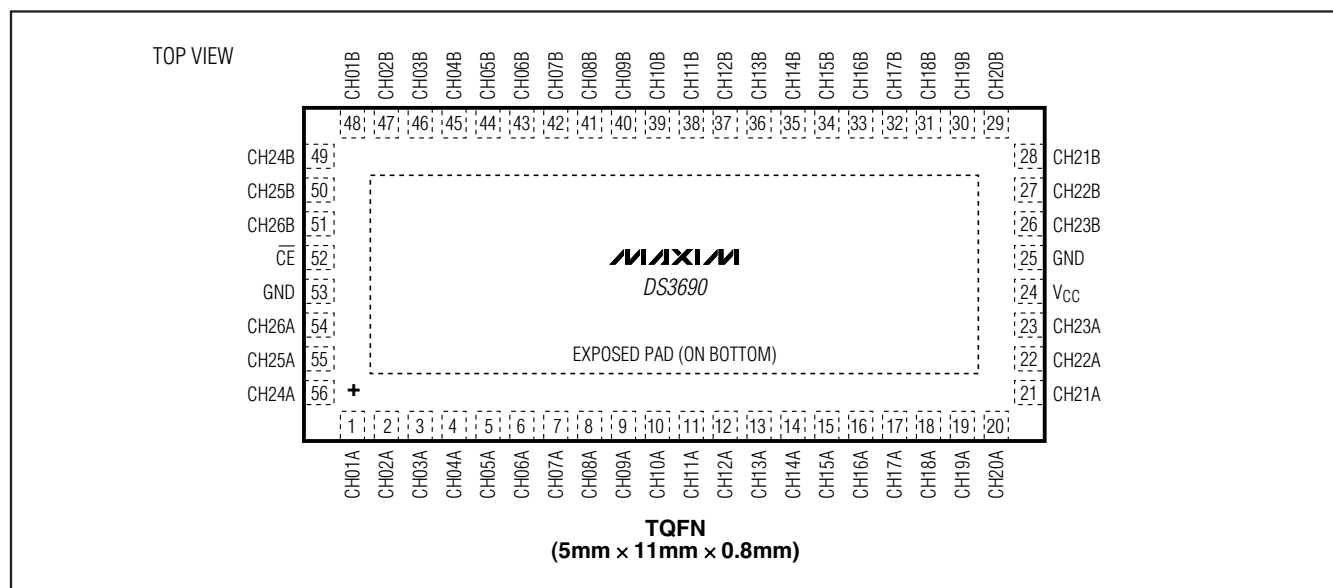
### Ordering Information

| PART        | TEMP RANGE     | PIN-PACKAGE |
|-------------|----------------|-------------|
| DS3690T+    | -55°C to +85°C | 56 TQFN     |
| DS3690T+TRL | -55°C to +85°C | 56 TQFN     |

+Denotes a lead-free package.

TRL = Tape and reel.

### Pin Configuration



Typical Operating Circuit appears at end of data sheet.



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## ABSOLUTE MAXIMUM RATINGS

Voltage Range on Any Pin Relative to Ground.....-0.5V to +6.0V  
Operating Temperature Range .....-55°C to +85°C

Storage Temperature Range .....-55°C to +125°C  
Soldering Temperature.....Refer to IPC/JEDEC J-STD-020

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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

(T<sub>A</sub> = -55°C to +85°C)

| PARAMETER      | SYMBOL          | CONDITIONS | MIN                   | TYP | MAX                   | UNITS |
|----------------|-----------------|------------|-----------------------|-----|-----------------------|-------|
| Supply Voltage | V <sub>CC</sub> | (Note 1)   | 2.7                   | 3.3 | 3.6                   | V     |
| Input Logic 1  | V <sub>IH</sub> | (Note 1)   | 0.7 x V <sub>CC</sub> |     | V <sub>CC</sub> + 0.3 | V     |
| Input Logic 0  | V <sub>IL</sub> | (Note 1)   | -0.3                  |     | 0.3 x V <sub>CC</sub> | V     |

## DC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = +2.7V to +3.6V, T<sub>A</sub> = -55°C to +85°C, unless otherwise noted.)

| PARAMETER                                 | SYMBOL          | CONDITIONS                                                               | MIN  | TYP | MAX  | UNITS |
|-------------------------------------------|-----------------|--------------------------------------------------------------------------|------|-----|------|-------|
| Standby Current                           | I <sub>CC</sub> | $\overline{CE} = CH1 \rightarrow CH26 = V_{CC}$ , I <sub>OUT</sub> = 0mA |      |     | 1    | μA    |
| Input Leakage Current ( $\overline{CE}$ ) | I <sub>I</sub>  | V <sub>IN</sub> = 0V to V <sub>CC</sub> , T <sub>A</sub> = +25°C         | -0.1 |     | +0.1 | μA    |
| I/O Leakage Current                       | I <sub>IO</sub> | $\overline{CE} = V_{IH}$                                                 | -1.0 |     | +1.0 | μA    |

## AC ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = +2.7V to +3.6V, T<sub>A</sub> = -55°C to +85°C, unless otherwise noted.)

| PARAMETER                            | SYMBOL           | CONDITIONS                        | MIN | TYP | MAX | UNITS |
|--------------------------------------|------------------|-----------------------------------|-----|-----|-----|-------|
| Propagation Delay (A to B or B to A) | t <sub>PD</sub>  | $\overline{CE} = V_{IL}$ (Note 2) |     |     | 10  | ns    |
| Chip Enable to Output Valid          | t <sub>CEV</sub> | (Notes 2, 3)                      |     |     | 20  | ns    |
| Chip Enable to Output Deselect       | t <sub>CEZ</sub> | (Notes 2, 3)                      |     |     | 20  | ns    |
| Input to $\overline{CE}$ Setup Time  | t <sub>IS</sub>  | (Note 4)                          | 0   |     |     | ns    |
| Skew Between Channels                | t <sub>S</sub>   | (Notes 5, 6)                      |     |     | 1   | ns    |

## AC TEST CONDITIONS

Input Pulse Levels: V<sub>IL</sub> = 0.0V, V<sub>IH</sub> = 2.7V  
Input Pulse Rise and Fall Times: 5ns  
Input and Output Timing Reference Level: V<sub>CC</sub>/2  
Output Load: C<sub>L</sub> (100pF)

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### CAPACITANCE

( $T_A = +25^\circ\text{C}$ )

| PARAMETER                                    | SYMBOL          | CONDITIONS            | MIN | TYP | MAX | UNITS |
|----------------------------------------------|-----------------|-----------------------|-----|-----|-----|-------|
| Input Capacitance ( $\overline{\text{CE}}$ ) | $C_{\text{IN}}$ | Not production tested |     | 5   |     | pF    |
| I/O Capacitance                              | $C_{\text{IO}}$ | Not production tested |     | 8   |     | pF    |

**Note 1:** All voltages referenced to ground.

**Note 2:** Typical waveform shown is labeled CHxxA (input) to CHxxB (output), and is identical in function when selecting pin CHxxB (as the input) to pin CHxxA (as the output).

**Note 3:** Output reference level is  $V_{\text{CC}}/2$ .

**Note 4:** Input transitions prior to the  $\overline{\text{CE}}$  falling edge are ignored (don't care).

**Note 5:** Propagation delay differential between any two channels when using a common input signal source.

**Note 6:** Guaranteed by design and not 100% tested.

### Timing Diagrams

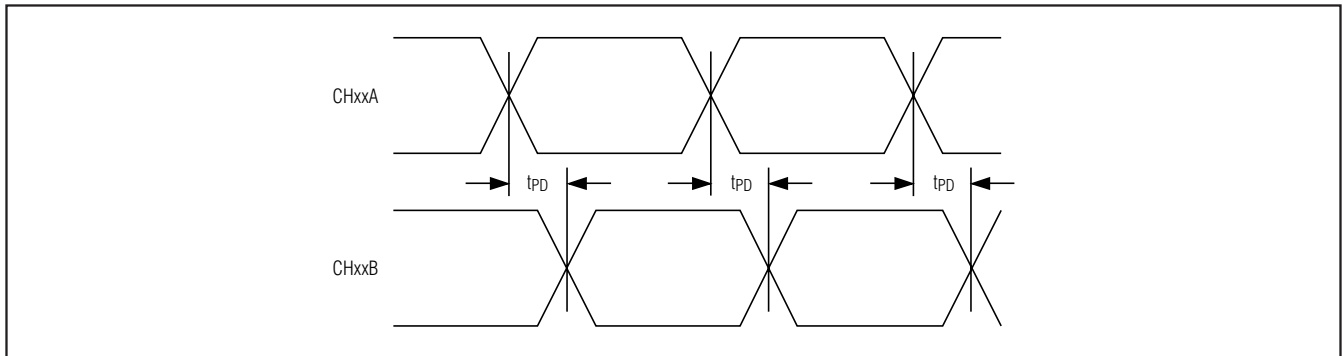


Figure 1. Digital Channel Propagation Delay

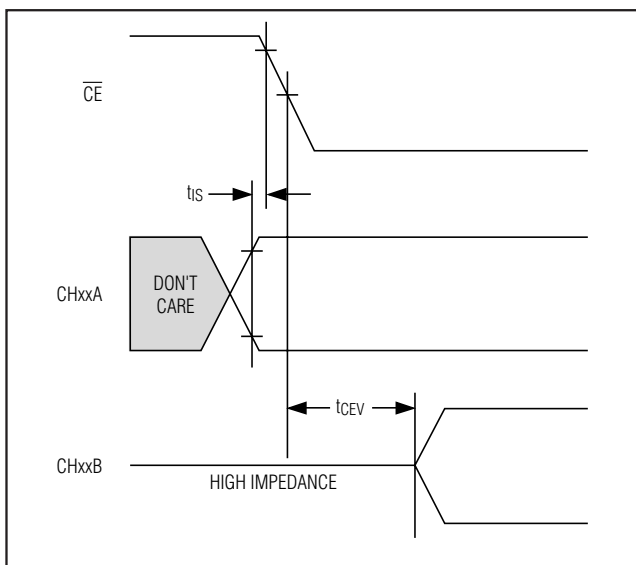


Figure 2. Digital Channels Enabled by  $\overline{\text{CE}}$

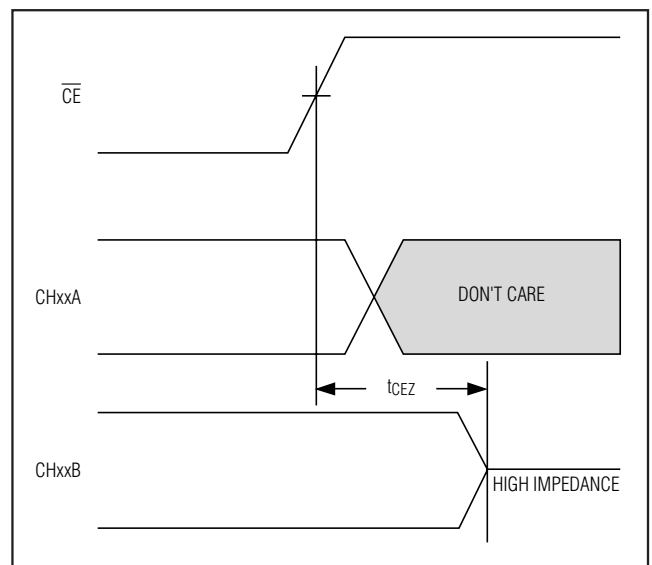
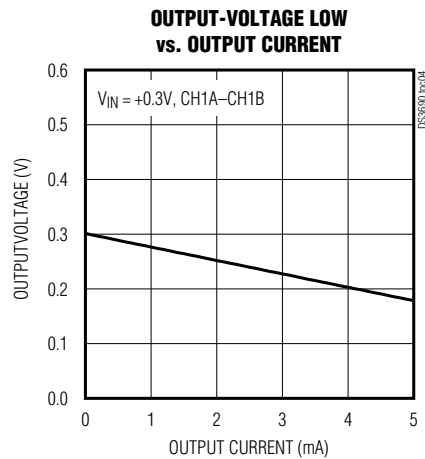
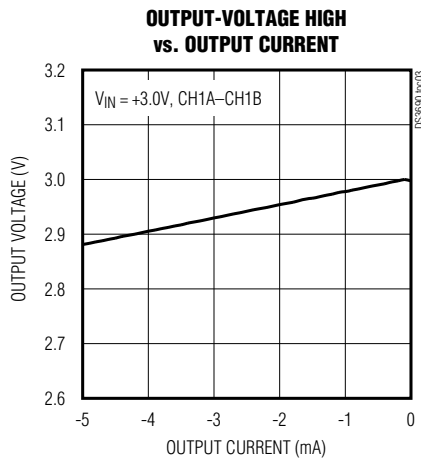
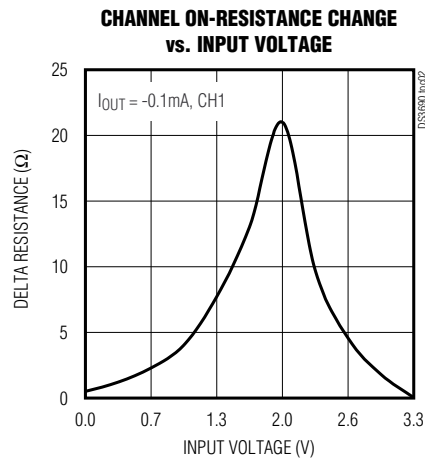
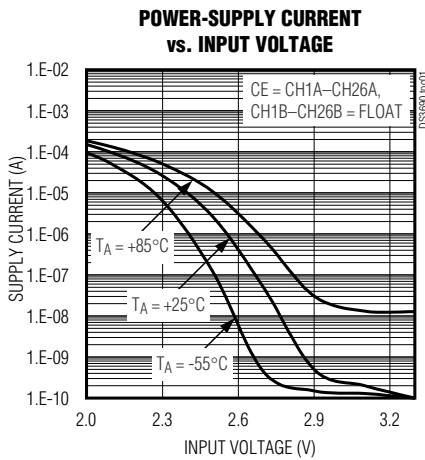


Figure 3. Digital Channels Disabled by  $\overline{\text{CE}}$

# 3.3V 26-Channel, Three-Stateable Transmission Gate

## Typical Operating Characteristics

( $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)



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## Pin Description

DS3690

| PIN    | NAME  | FUNCTION              |
|--------|-------|-----------------------|
| 1      | CH01A | Channel 1 Terminal A  |
| 2      | CH02A | Channel 2 Terminal A  |
| 3      | CH03A | Channel 3 Terminal A  |
| 4      | CH04A | Channel 4 Terminal A  |
| 5      | CH05A | Channel 5 Terminal A  |
| 6      | CH06A | Channel 6 Terminal A  |
| 7      | CH07A | Channel 7 Terminal A  |
| 8      | CH08A | Channel 8 Terminal A  |
| 9      | CH09A | Channel 9 Terminal A  |
| 10     | CH10A | Channel 10 Terminal A |
| 11     | CH11A | Channel 11 Terminal A |
| 12     | CH12A | Channel 12 Terminal A |
| 13     | CH13A | Channel 13 Terminal A |
| 14     | CH14A | Channel 14 Terminal A |
| 15     | CH15A | Channel 15 Terminal A |
| 16     | CH16A | Channel 16 Terminal A |
| 17     | CH17A | Channel 17 Terminal A |
| 18     | CH18A | Channel 18 Terminal A |
| 19     | CH19A | Channel 19 Terminal A |
| 20     | CH20A | Channel 20 Terminal A |
| 21     | CH21A | Channel 21 Terminal A |
| 22     | CH22A | Channel 22 Terminal A |
| 23     | CH23A | Channel 23 Terminal A |
| 24     | VCC   | Supply Voltage        |
| 25, 53 | GND   | Ground                |
| 26     | CH23B | Channel 23 Terminal B |
| 27     | CH22B | Channel 22 Terminal B |
| 28     | CH21B | Channel 21 Terminal B |
| 29     | CH20B | Channel 20 Terminal B |

| PIN | NAME                   | FUNCTION                                     |
|-----|------------------------|----------------------------------------------|
| 30  | CH19B                  | Channel 19 Terminal B                        |
| 31  | CH18B                  | Channel 18 Terminal B                        |
| 32  | CH17B                  | Channel 17 Terminal B                        |
| 33  | CH16B                  | Channel 16 Terminal B                        |
| 34  | CH15B                  | Channel 15 Terminal B                        |
| 35  | CH14B                  | Channel 14 Terminal B                        |
| 36  | CH13B                  | Channel 13 Terminal B                        |
| 37  | CH12B                  | Channel 12 Terminal B                        |
| 38  | CH11B                  | Channel 11 Terminal B                        |
| 39  | CH10B                  | Channel 10 Terminal B                        |
| 40  | CH09B                  | Channel 9 Terminal B                         |
| 41  | CH08B                  | Channel 8 Terminal B                         |
| 42  | CH07B                  | Channel 7 Terminal B                         |
| 43  | CH06B                  | Channel 6 Terminal B                         |
| 44  | CH05B                  | Channel 5 Terminal B                         |
| 45  | CH04B                  | Channel 4 Terminal B                         |
| 46  | CH03B                  | Channel 3 Terminal B                         |
| 47  | CH02B                  | Channel 2 Terminal B                         |
| 48  | CH01B                  | Channel 1 Terminal B                         |
| 49  | CH24B                  | Channel 24 Terminal B                        |
| 50  | CH25B                  | Channel 25 Terminal B                        |
| 51  | CH26B                  | Channel 26 Terminal B                        |
| 52  | $\overline{\text{CE}}$ | Chip-Enable Input (Active Low)               |
| 54  | CH26A                  | Channel 26 Terminal A                        |
| 55  | CH25A                  | Channel 25 Terminal A                        |
| 56  | CH24A                  | Channel 24 Terminal A                        |
| —   | EP                     | Exposed Paddle. Must be connected to ground. |

## 3.3V 26-Channel, Three-Stateable Transmission Gate

### Detailed Description

The DS3690 is a 26-channel, noninverting, bidirectional CMOS transmission gate, and is intended for use in applications where a downstream component must be isolated from a common control, address, or data bus in a timely fashion. Each of the 26 independent channels can be used for input, output, or I/O signal applications. The chip-enable input ( $\overline{CE}$ ) allows gated bus control for either signal transmission or bus isolation.

Each independent channel consists of two pins ("CHxxA" and "CHxxB" where xx is 01–26). Since all 26 channels are capable of bidirectional function, either CHxxA or CHxxB can be selected as the input pin for any unidirectional signal requirements. A change of logic state on one side of any channel is directly reflected on the other side of that channel. Signal propagation delay (CHxxA to CHxxB, or CHxxB to CHxxA) is illustrated in Figure 1 as  $t_{PD}$ .

All channels can be simultaneously enabled or forced to a high-impedance state using the  $\overline{CE}$  input. When  $\overline{CE}$  becomes a logic zero, all channels are enabled for signal transmission within  $t_{CEV}$  (see Figure 2). When  $\overline{CE}$  becomes a logic one, all channels are forced to a high-impedance state within  $t_{CEZ}$  (see Figure 3).

### Applications Information

#### Power-Supply Decoupling

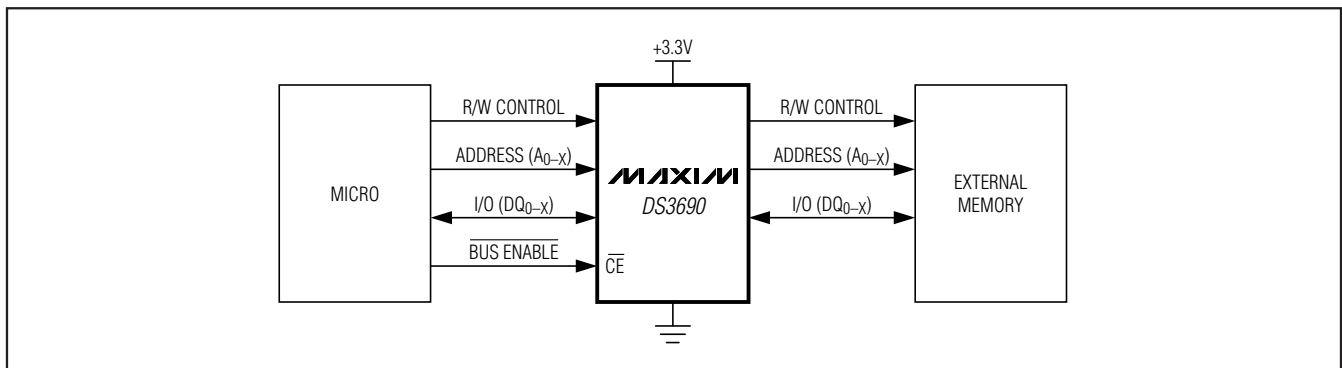
To achieve the best results when using the DS3690, decouple the power supply with a 0.1 $\mu$ F capacitor. Use a high-quality, ceramic surface-mount capacitor if possible. Surface-mount components minimize lead inductance, which improves performance, while ceramic capacitors have adequately high-frequency response for decoupling applications.

#### Pin Connections

For optimum circuit operation, connect pins 25 and 53 to a common ground. The exposed pad on the package bottom side should be connected to ground.

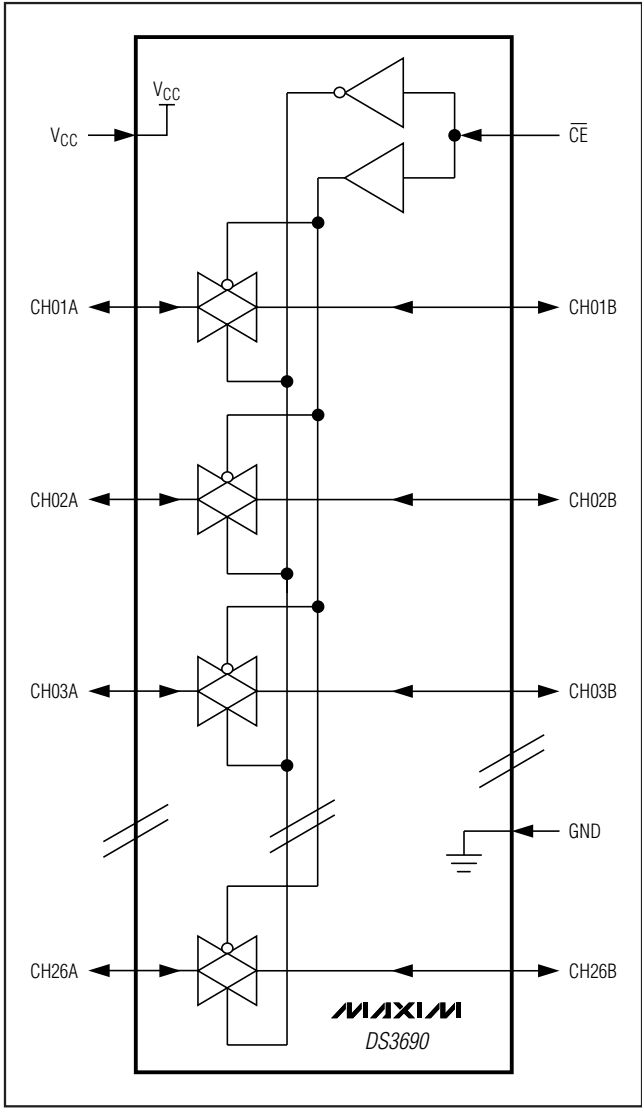
To prevent an unused transmission channel from generating any undesired activity, it is recommended that **one side** of that unused channel be connected to ground (either the A or B terminal, at the designer's discretion).

### Typical Operating Circuit



# 3.3V 26-Channel, Three-Stateable Transmission Gate

## Functional Diagram



## Package Information

(For the latest package outline information, go to [www.maxim-ic.com/DallasPackInfo](http://www.maxim-ic.com/DallasPackInfo).)

| PACKAGE TYPE | DOCUMENT NO.            |
|--------------|-------------------------|
| 56 TQFN      | <a href="#">21-0187</a> |

DS3690

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