



# SGM4782

## 0.5Ω, High Speed, Low Voltage Analog Switch/Multiplexer

### GENERAL DESCRIPTION

The SGM4782 is high-speed, low-voltage, low on-resistance, CMOS analog multiplexer/switch that configured as two 4-channel multiplexers. It operates from a single +1.8V to +4.2V power supply. Targeted applications include battery powered equipment that benefit from low  $R_{ON}$  (0.5Ω) and fast switching speeds ( $t_{ON} = 20ns$ ,  $t_{OFF} = 20ns$ ).

The SGM4782 can handle rail-to-rail analog signals and is available in Green TQFN-3×3-16L and TSSOP-16 packages.

### FEATURES

- **Voltage Operation: 1.8V to 4.2V**
- **Low On-Resistance: 0.5Ω (TYP) at 4.2V**
- **Low On-Resistance Flatness**
- **-3dB Bandwidth: 30MHz**
- **Fast Switching Times (+4.2V)**
  - $t_{ON}$  20ns
  - $t_{OFF}$  20ns
- **Low Crosstalk: -108dB at 1MHz**
- **Typical Power Consumption (< 0.01μW)**
- **TTL/CMOS Compatible**
- **Rail-to-Rail Input and Output Operation**
- **Break-Before-Make Switching**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TQFN-3×3-16L and TSSOP-16 Packages**

### APPLICATIONS

Communication Systems  
Cell Phones  
Portable Instrumentation  
Audio Signal Routing  
Audio and Video Switching  
Computer Peripherals  
Low-Voltage Data-Acquisition Systems

**PACKAGE/ORDERING INFORMATION**

| MODEL   | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING         | PACKING OPTION      |
|---------|---------------------|-----------------------------|-----------------|-------------------------|---------------------|
| SGM4782 | TQFN-3x3-16L        | -40°C to +85°C              | SGM4782YTQ16/TR | 4782TQ<br>XXXXX         | Tape and Reel, 3000 |
|         | TSSOP-16            | -40°C to +85°C              | SGM4782YTS/TR   | SGM4782<br>YTS<br>XXXXX | Tape and Reel, 3000 |

NOTE: XXXXX = Date Code and Vendor Code.

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

V<sub>+</sub> to GND .....0V to 4.6V  
 Analog, Digital Voltage Range .....-0.3V to (V<sub>+</sub>) + 0.3V  
 Continuous Current X<sub>-</sub>, Y<sub>-</sub>, X or Y .....±250mA  
 Peak Current X<sub>-</sub>, Y<sub>-</sub>, X or Y .....±400mA  
 Junction Temperature .....+150°C  
 Storage Temperature Range .....-65°C to +150°C  
 Lead Temperature (Soldering, 10s) .....+260°C  
 ESD Susceptibility  
 HBM ..... 4000V  
 MM ..... 400V

NOTE: 1. Voltages exceeding V<sub>CC</sub> or V<sub>EE</sub> on any signal terminal are clamped by internal diodes. Limit forward-diode current to maximum current rating.

**RECOMMENDED OPERATING CONDITIONS**

Operating Temperature Range .....-40°C to +85°C

**OVERSTRESS CAUTION**

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

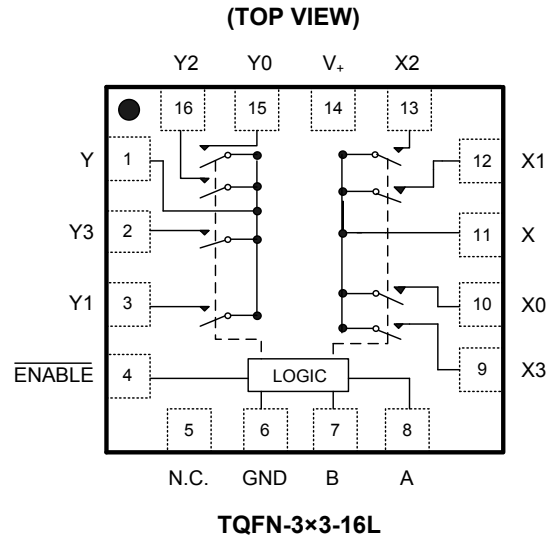
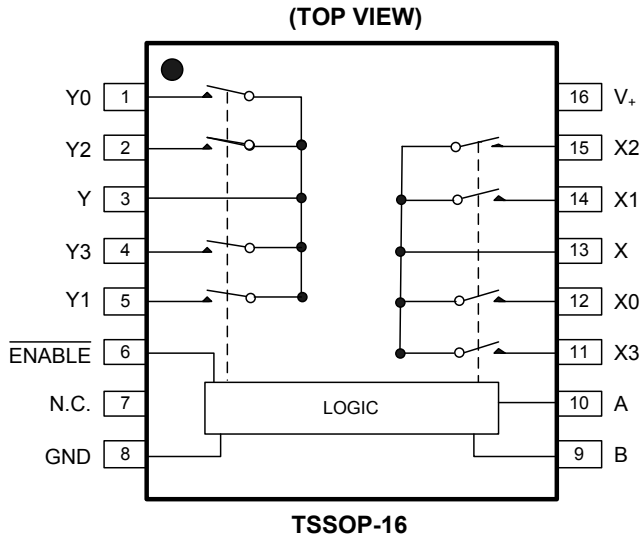
**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PIN CONFIGURATIONS



PIN DESCRIPTION

| PIN            |               | NAME                       | FUNCTION  |
|----------------|---------------|----------------------------|---|
| TSSOP-16       | TQFN-3x3-16L  |                            |   |
| 1, 5, 2, 4     | 15, 3, 16, 2  | Y0-Y3                      | Analog Switch Y Inputs Y0-Y3.   |
| 3              | 1             | Y                          | Analog Switch Y Output.   |
| 6              | 4             | $\overline{\text{ENABLE}}$ | Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off. |
| 7              | 5             | N.C.                       | Not Internally Connected.   |
| 8              | 6             | GND                        | Ground.   |
| 9              | 7             | B                          | Digital Address B Input.  |
| 10             | 8             | A                          | Digital Address A Input.  |
| 12, 14, 15, 11 | 10, 12, 13, 9 | X0-X3                      | Analog Switch X Inputs X0-X3.   |
| 13             | 11            | X                          | Analog Switch X Output.   |
| 16             | 14            | V+                         | Positive Analog and Digital Supply Voltage Input.   |
| —              | Exposed Pad   | GND                        | Exposed pad should be soldered to PCB board and connected to GND.                           |

FUNCTION TABLE

| CONTROL INPUTS |        |   | ON SWITCHES       |
|----------------|--------|---|-------------------|
| Enable         | Select |   |                   |
|                | B      | A |                   |
| L              | L      | L | X-X0    Y-Y0      |
| L              | L      | H | X-X1    Y-Y1      |
| L              | H      | L | X-X2    Y-Y2      |
| L              | H      | H | X-X3    Y-Y3      |
| H              | √      | √ | All Switches Open |

NOTE: √ = Don't Care.

## ELECTRICAL CHARACTERISTICS

(V<sub>+</sub> = +4.2V, GND = 0V, V<sub>IH</sub> = +1.6V, V<sub>IL</sub> = +0.6V, Full = -40°C to +85°C. Typical values are at V<sub>+</sub> = +4.2V, T<sub>A</sub> = +25°C, unless otherwise noted.)

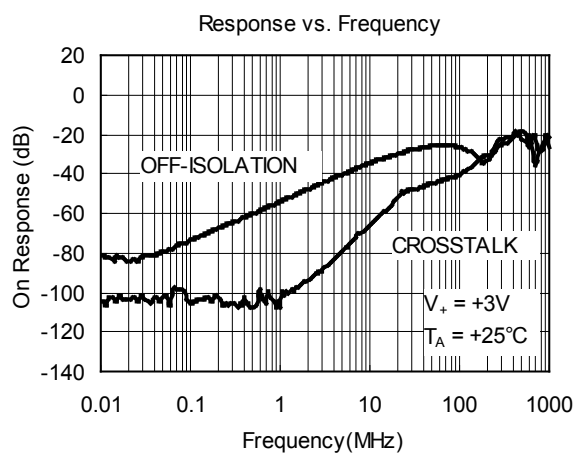
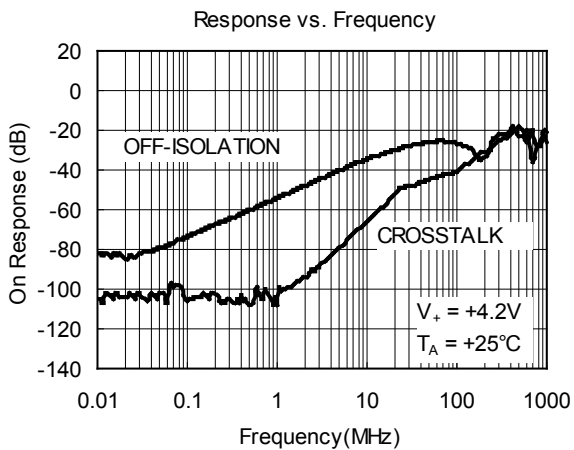
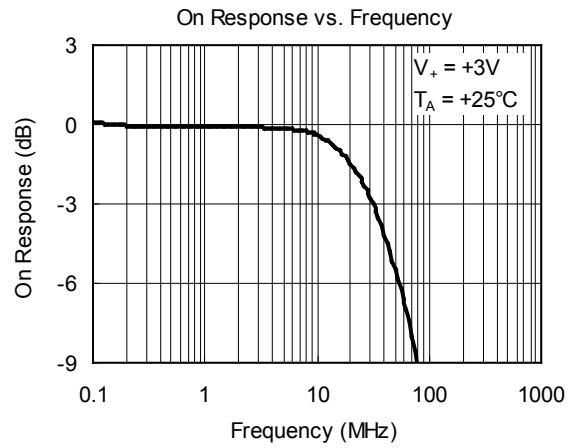
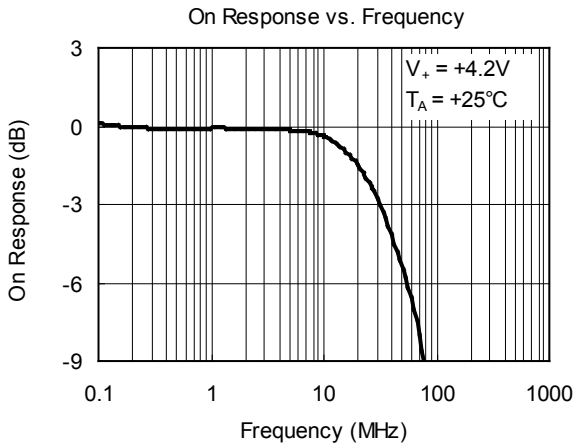
| PARAMETER                            | SYMBOL  | CONDITIONS   | TEMP   | MIN   | TYP  | MAX            | UNITS |
|--------------------------------------|---|--|--------|-------|------|----------------|-------|
| <b>ANALOG SWITCH</b>                 |   |  |        |       |      |                |       |
| Analog Signal Range                  | $V_{X-}, V_{Y-}, V_{X+}, V_{Y+}$  |  | Full   | 0     |      | V <sub>+</sub> | V     |
| On-Resistance                        | R <sub>ON</sub>   | V <sub>+</sub> = 4.2V, I <sub>X-</sub> , I <sub>Y-</sub> = -100mA, V <sub>X</sub> , V <sub>Y</sub> = 1V, Test Circuit 1            | +25°C  |       | 0.5  | 0.85           | Ω     |
|                                      |   |  | Full   |       |      | 0.95           |       |
| On-Resistance Match Between Channels | ΔR <sub>ON</sub>  | V <sub>+</sub> = 4.2V, I <sub>X-</sub> , I <sub>Y-</sub> = -100mA, V <sub>X</sub> , V <sub>Y</sub> = 1V, Test Circuit 1            | +25°C  |       | 0.05 | 0.2            | Ω     |
|                                      |   |  | Full   |       |      | 0.24           |       |
| On-Resistance Flatness               | R <sub>FLAT(ON)</sub>   | V <sub>+</sub> = 4.2V, I <sub>X-</sub> , I <sub>Y-</sub> = -100mA, V <sub>X</sub> , V <sub>Y</sub> = 1V, 2.5V, Test Circuit 1      | +25°C  |       | 0.1  | 0.2            | Ω     |
|                                      |   |  | Full   |       |      | 0.24           |       |
| Source OFF Leakage Current           | I <sub>X(OFF)</sub> , I <sub>Y(OFF)</sub>   | V <sub>+</sub> = 4.2V, V <sub>X</sub> , V <sub>Y</sub> = 3.3V, 0.3V, V <sub>X</sub> , V <sub>Y</sub> = 0.3V, 3.3V                  | Full   |       |      | 1              | μA    |
| Channel ON Leakage Current           | I <sub>X(ON)</sub> , I <sub>Y(ON)</sub> , I <sub>X(OFF)</sub> , I <sub>Y(OFF)</sub> | V <sub>+</sub> = 4.2V, V <sub>X</sub> , V <sub>Y</sub> = 0.3V, 3.3V, V <sub>X-</sub> , V <sub>Y-</sub> = 0.3V, 3.3V or floating    | Full   |       |      | 1              | μA    |
| <b>DIGITAL INPUTS</b>                |   |  |        |       |      |                |       |
| Input High Voltage                   | V <sub>INH</sub>  |  | Full   | 1.6   |      |                | V     |
| Input Low Voltage                    | V <sub>INL</sub>  |  | Full   |       |      | 0.5            | V     |
| Input Leakage Current                | I <sub>IN-</sub>  | V <sub>A</sub> , V <sub>B</sub> = V <sub>ENABLE</sub> = 0V or 4.2V   | Full   |       |      | 1              | μA    |
| <b>DYNAMIC CHARACTERISTICS</b>       |   |  |        |       |      |                |       |
| Turn-On Time                         | t <sub>ON</sub>   | V <sub>IN</sub> = 1.5V to 0.5V, V <sub>X</sub> or V <sub>Y</sub> = 2.1V  | +25°C  |       | 20   |                | ns    |
| Turn-Off Time                        | t <sub>OFF</sub>  | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 2  | +25°C  |       | 20   |                |       |
| Address Transition Time              | t <sub>TRANS</sub>  | V <sub>IN</sub> = 4.2V to 0V, V <sub>X</sub> or V <sub>Y</sub> = 2.1V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 3 | +25°C  |       | 30   |                | ns    |
| Break-Before-Make Time Delay         | t <sub>D</sub>  | V <sub>IN</sub> = 4.2V to 0V, V <sub>X</sub> or V <sub>Y</sub> = 2.1V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 4 | +25°C  |       | 20   |                | ns    |
| Charge Injection                     | Q   | C <sub>L</sub> = 1nF, Test Circuit 5   | +25°C  |       | -18  |                | pC    |
| Off Isolation                        | O <sub>ISO</sub>  | Signal = 0dBm, V <sub>BIAS</sub> = 2.1V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 6                               | 100kHz | +25°C |      | -75            | dB    |
|                                      |   |  | 1MHz   | +25°C |      | -55            |       |
| Channel-to-Channel Crosstalk         | X <sub>TALK</sub>   | Signal = 0dBm, V <sub>BIAS</sub> = 2.1V, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 6                               | 100kHz | +25°C |      | -106           | dB    |
|                                      |   |  | 1MHz   | +25°C |      | -108           |       |
| -3dB Bandwidth                       | BW  | Signal = 0dBm, V <sub>BIAS</sub> = 2.1V, R <sub>L</sub> = 50Ω, Test Circuit 6  | +25°C  |       | 30   |                | MHz   |
| Channel ON Capacitance               | C <sub>X(ON)</sub> , C <sub>Y(ON)</sub> , C <sub>X(OFF)</sub> , C <sub>Y(OFF)</sub> |  | +25°C  |       | 146  |                | pF    |
| <b>POWER REQUIREMENTS</b>            |   |  |        |       |      |                |       |
| Power Supply Range                   | V <sub>+</sub>  |  | Full   | 1.8   |      | 4.2            | V     |
| Power Supply Current                 | I <sub>+</sub>  | V <sub>+</sub> = 4.2V, V <sub>A</sub> , V <sub>B</sub> , V <sub>ENABLE</sub> = 4.2V or 0V  | Full   |       |      | 1              | μA    |

**ELECTRICAL CHARACTERISTICS (continued)**

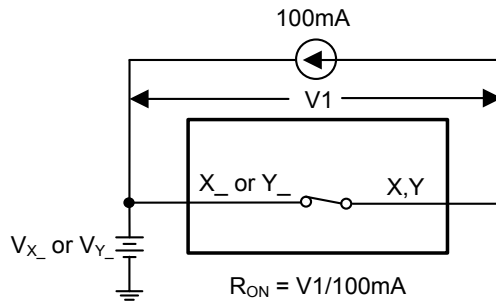
(V<sub>+</sub> = +2.7V to +3.6V, GND = 0V, V<sub>IH</sub> = +1.6V, V<sub>IL</sub> = +0.4V, Full = -40°C to +85°C. Typical values are at V<sub>+</sub> = +3.0V, T<sub>A</sub> = +25°C, unless otherwise noted.)

| PARAMETER                            | SYMBOL   | CONDITIONS  | TEMP   | MIN   | TYP  | MAX            | UNITS |
|--------------------------------------|--|---|--------|-------|------|----------------|-------|
| <b>ANALOG SWITCH</b>                 |  |   |        |       |      |                |       |
| Analog Signal Range                  | V <sub>X-</sub> , V <sub>Y-</sub> ,<br>V <sub>X</sub> , V <sub>Y</sub>                 |   | Full   | 0     |      | V <sub>+</sub> | V     |
| On-Resistance                        | R <sub>ON</sub>  | V <sub>+</sub> = 2.7V, I <sub>X-</sub> , I <sub>Y-</sub> = -100mA, V <sub>X</sub> , V <sub>Y</sub> = 1V,<br>Test Circuit 1              | +25°C  |       | 0.6  | 0.95           | Ω     |
|                                      |  |   | Full   |       |      | 1.05           |       |
| On-Resistance Match Between Channels | ΔR <sub>ON</sub>   | V <sub>+</sub> = 2.7V, I <sub>X-</sub> , I <sub>Y-</sub> = -100mA, V <sub>X</sub> , V <sub>Y</sub> = 1V,<br>Test Circuit 1              | +25°C  |       | 0.05 | 0.2            | Ω     |
|                                      |  |   | Full   |       |      | 0.24           |       |
| On-Resistance Flatness               | R <sub>FLAT(ON)</sub>  | V <sub>+</sub> = 2.7V, I <sub>X-</sub> , I <sub>Y-</sub> = -100mA,<br>V <sub>X</sub> , V <sub>Y</sub> = 1V, 2.5V, Test Circuit 1        | +25°C  |       | 0.1  | 0.2            | Ω     |
|                                      |  |   | Full   |       |      | 0.24           |       |
| Source OFF Leakage Current           | I <sub>X-(OFF)</sub> ,<br>I <sub>Y-(OFF)</sub>   | V <sub>+</sub> = 3.6V, V <sub>X-</sub> , V <sub>Y-</sub> = 3.3V, 0.3V,<br>V <sub>X</sub> , V <sub>Y</sub> = 0.3V, 3.3V                  | Full   |       |      | 1              | μA    |
| Channel ON Leakage Current           | I <sub>X-(ON)</sub> , I <sub>Y-(ON)</sub> ,<br>I <sub>X(ON)</sub> , I <sub>Y(ON)</sub> | V <sub>+</sub> = 3.6V, V <sub>X</sub> , V <sub>Y</sub> = 0.3V, 3.3V,<br>V <sub>X-</sub> , V <sub>Y-</sub> = 0.3V, 3.3V or floating      | Full   |       |      | 1              | μA    |
| <b>DIGITAL INPUTS</b>                |  |   |        |       |      |                |       |
| Input High Voltage                   | V <sub>INH</sub>   |   | Full   | 1.5   |      |                | V     |
| Input Low Voltage                    | V <sub>INL</sub>   |   | Full   |       |      | 0.4            | V     |
| Input Leakage Current                | I <sub>IN-</sub>   | V <sub>A</sub> , V <sub>B</sub> = V <sub>ENABLE</sub> = 0V or 2.7V  | Full   |       |      | 1              | μA    |
| <b>DYNAMIC CHARACTERISTICS</b>       |  |   |        |       |      |                |       |
| Turn-On Time                         | t <sub>ON</sub>  | V <sub>IN</sub> = 1.5V to 0.5V, V <sub>X</sub> or V <sub>Y</sub> = 1.5V,<br>R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 2 | +25°C  |       | 33   |                | ns    |
| Turn-Off Time                        | t <sub>OFF</sub>   |   | +25°C  |       | 20   |                |       |
| Address Transition Time              | t <sub>TRANS</sub>   | V <sub>IN</sub> = 1.5V to 0V, V <sub>X</sub> or V <sub>Y</sub> = 1.5V,<br>R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 3   | +25°C  |       | 36   |                | ns    |
| Break-Before-Make Time Delay         | t <sub>D</sub>   | V <sub>IN</sub> = 1.5V to 0V, V <sub>X</sub> or V <sub>Y</sub> = 1.5V,<br>R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF, Test Circuit 4   | +25°C  |       | 18   |                | ns    |
| Charge Injection                     | Q  | C <sub>L</sub> = 1nF, Test Circuit 5  | +25°C  |       | -18  |                | pC    |
| Off Isolation                        | O <sub>ISO</sub>   | Signal = 0dBm, V <sub>BIAS</sub> = 1.5V,<br>R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF,<br>Test Circuit 6                              | 100kHz | +25°C |      | -75            | dB    |
|                                      |  |   | 1MHz   | +25°C |      | -55            |       |
| Channel-to-Channel Crosstalk         | X <sub>TALK</sub>  | Signal = 0dBm, V <sub>BIAS</sub> = 1.5V,<br>R <sub>L</sub> = 50Ω, C <sub>L</sub> = 35pF,<br>Test Circuit 6                              | 100kHz | +25°C |      | -106           | dB    |
|                                      |  |   | 1MHz   | +25°C |      | -108           |       |
| -3dB Bandwidth                       | BW   | Signal = 0dBm, V <sub>BIAS</sub> = 1.5V, R <sub>L</sub> = 50Ω,<br>Test Circuit 6  | +25°C  |       | 30   |                | MHz   |
| Channel ON Capacitance               | C <sub>X-(ON)</sub> , C <sub>Y-(ON)</sub> ,<br>C <sub>X(ON)</sub> , C <sub>Y(ON)</sub> |   | +25°C  |       | 146  |                | pF    |

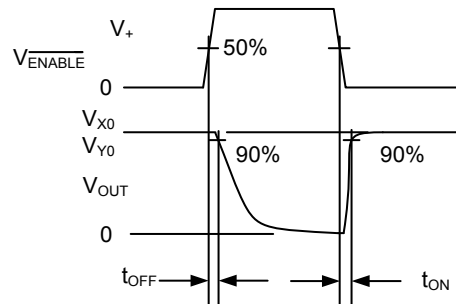
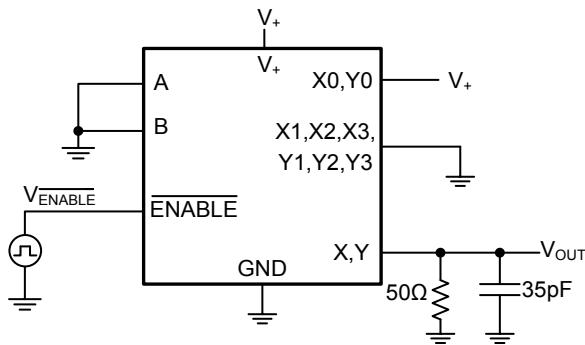
TYPICAL PERFORMANCE CHARACTERISTICS



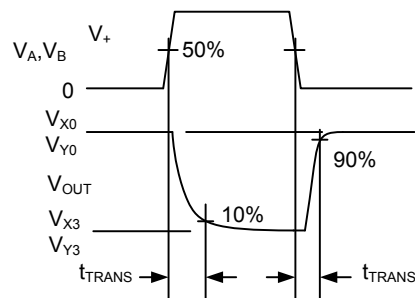
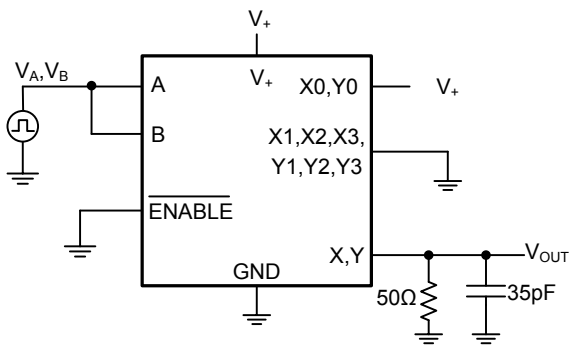
TEST CIRCUITS



Test Circuit 1. On Resistance

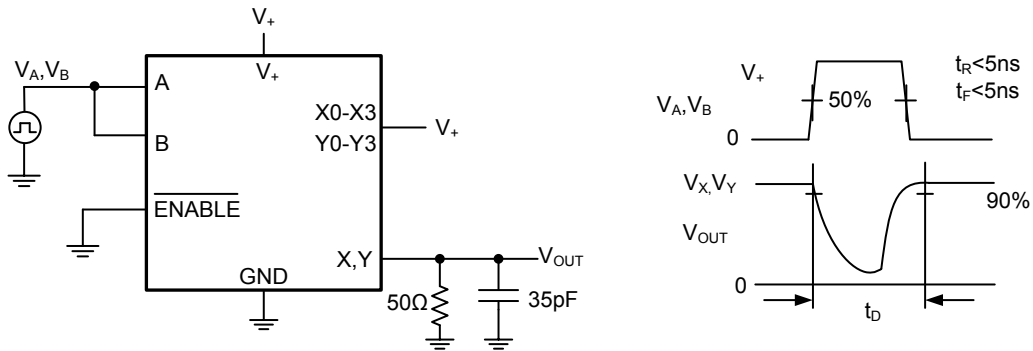


Test Circuit 2. Enable Switching Times ( $t_{OFF}$ ,  $t_{ON}$ )

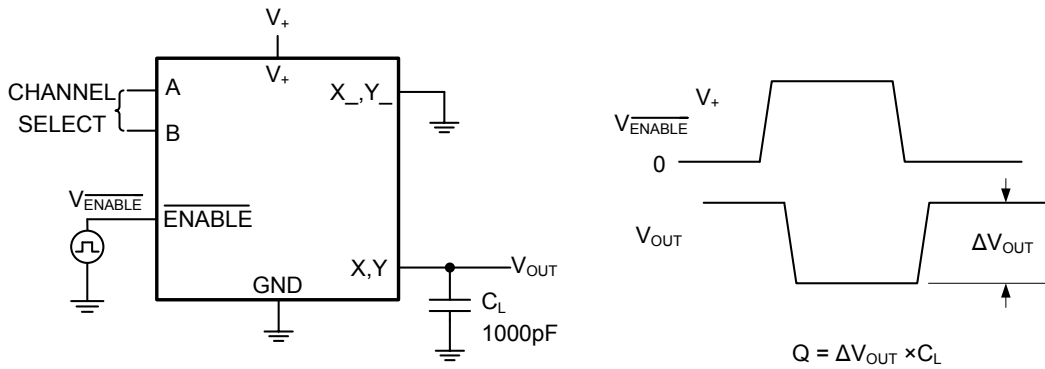


Test Circuit 3. Address Transition Times ( $t_{TRANS}$ )

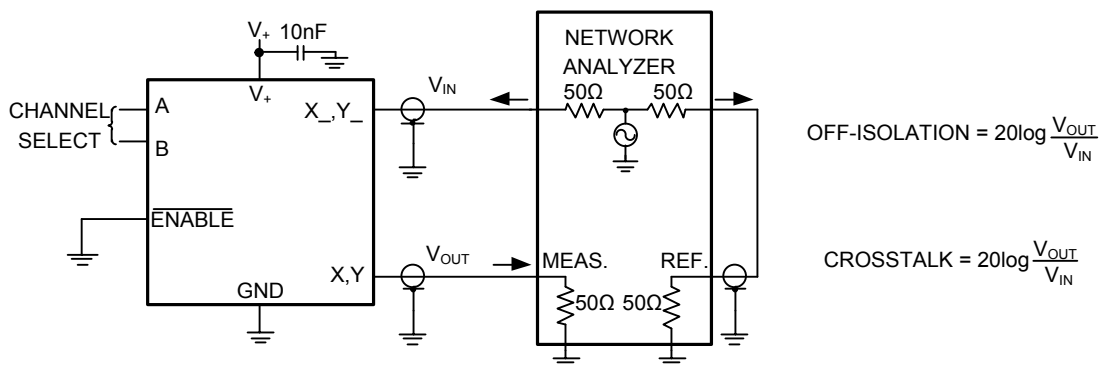
TEST CIRCUITS (continued)



Test Circuit 4. Break-Before-Make Interval ( $t_d$ )



Test Circuit 5. Charge Injection ( $Q$ )

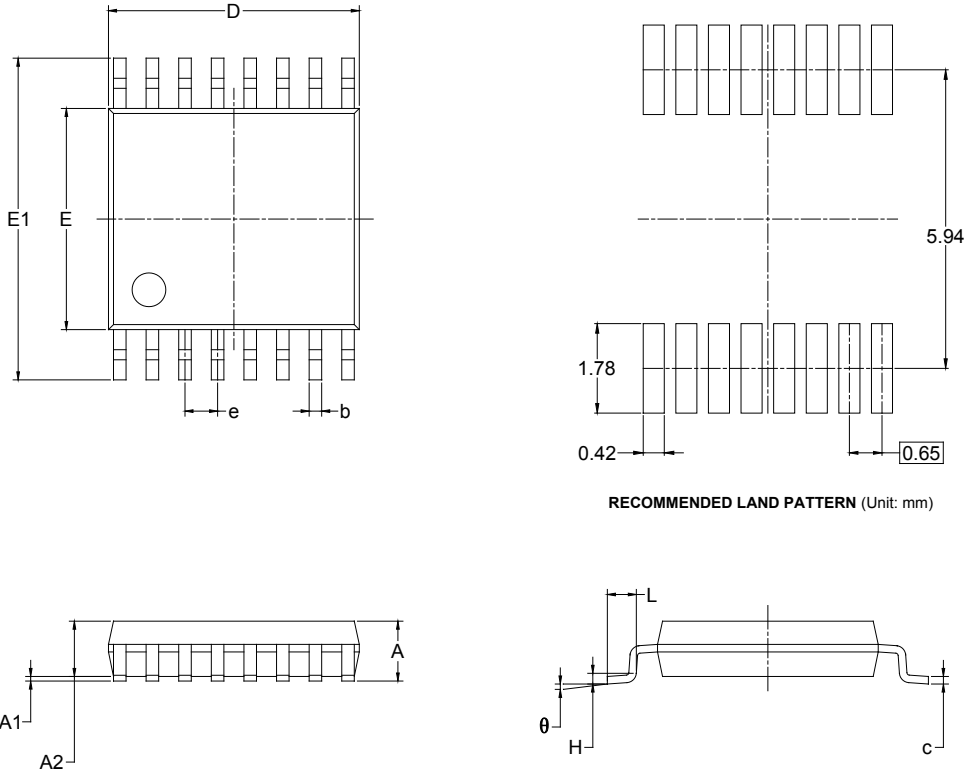


Test Circuit 6. -3dB Bandwidth, Off-Isolation and Crosstalk



PACKAGE OUTLINE DIMENSIONS

TSSOP-16



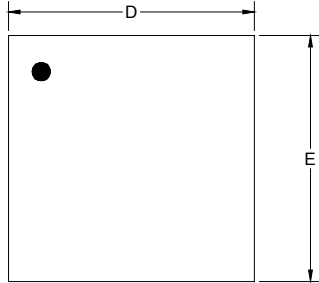
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol   | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|----------|------------------------------|-------|-------------------------|-------|
|          | MIN                          | MAX   | MIN                     | MAX   |
| A        |                              | 1.100 |                         | 0.043 |
| A1       | 0.050                        | 0.150 | 0.002                   | 0.006 |
| A2       | 0.800                        | 1.000 | 0.031                   | 0.039 |
| b        | 0.190                        | 0.300 | 0.007                   | 0.012 |
| c        | 0.090                        | 0.200 | 0.004                   | 0.008 |
| D        | 4.900                        | 5.100 | 0.193                   | 0.201 |
| E        | 4.300                        | 4.500 | 0.169                   | 0.177 |
| E1       | 6.250                        | 6.550 | 0.246                   | 0.258 |
| e        | 0.650 BSC                    |       | 0.026 BSC               |       |
| L        | 0.500                        | 0.700 | 0.02                    | 0.028 |
| H        | 0.25 TYP                     |       | 0.01 TYP                |       |
| $\theta$ | 1°                           | 7°    | 1°                      | 7°    |

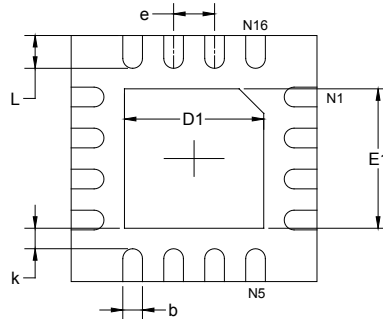
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

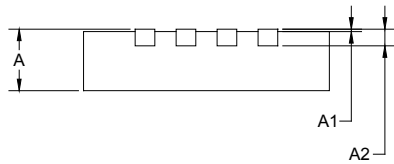
### TQFN-3×3-16L



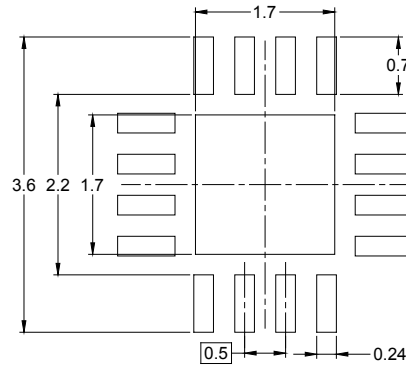
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.700                        | 0.800 | 0.028                   | 0.031 |
| A1     | 0.000                        | 0.050 | 0.000                   | 0.002 |
| A2     | 0.203 REF                    |       | 0.008 REF               |       |
| D      | 2.900                        | 3.100 | 0.114                   | 0.122 |
| D1     | 1.600                        | 1.800 | 0.063                   | 0.071 |
| E      | 2.900                        | 3.100 | 0.114                   | 0.122 |
| E1     | 1.600                        | 1.800 | 0.063                   | 0.071 |
| k      | 0.200 MIN                    |       | 0.008 MIN               |       |
| b      | 0.180                        | 0.300 | 0.007                   | 0.012 |
| e      | 0.500 TYP                    |       | 0.020 TYP               |       |
| L      | 0.300                        | 0.500 | 0.012                   | 0.020 |

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TSSOP-16     | 13"           | 12.4               | 6.90    | 5.60    | 1.20    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| TQFN-3×3-16L | 13"           | 12.4               | 3.35    | 3.35    | 1.13    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |

DD0001

# PACKAGE INFORMATION

## CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

| Reel Type | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|-----------|-------------|------------|-------------|--------------|
| 13"       | 386         | 280        | 370         | 5            |

DD0002