# SGM4518
# 36V High Voltage, CMOS Analog Multiplexer

## GENERAL DESCRIPTION

The SGM4518 is a high voltage, CMOS analog IC configured as an 8-channel multiplexer.

This CMOS device can operate from ±3.2V to ±18V dual power supplies or from +3.2V to +36V single supply. Each switch can handle rail-to-rail analog signals. The off leakage current is only 0.01μA (TYP).

All digital inputs have 0.8V to 2.4V logic thresholds, ensuring TTL/CMOS-logic compatibility when using a single +5V supply or dual ±5V supplies.

The SGM4518 is available in Green SOIC-16, SSOP-16, TSSOP-16 and TQFN-3×3-16L packages. It operates over an operating temperature range of -40℃ to +125℃.

## FEATURES

- On-Resistance:
  22Ω (TYP) with Single 36V Supply
- Low Off Leakage Current: 0.01μA (TYP)
- Low On Leakage Current: 0.01μA (TYP)
- ±3.2V to ±18V Dual-Supply Operation or +3.2V to +36V Single-Supply Operation
- TTL/CMOS-Logic Compatible
- Low Distortion: 0.001% (TYP) ($R_L$ = 600Ω, f = 1kHz)
- High Off-Isolation: -85dB (TYP) ($R_L$ = 50Ω, f = 1MHz)
- -40℃ to +125℃ Operating Temperature Range
- Available in Green SOIC-16, SSOP-16, TSSOP-16 and TQFN-3×3-16L Packages

## APPLICATIONS

Battery-Operated Equipment
Audio and Video Signal Routing
Low Voltage Data Acquisition Systems
Communications Circuits

## PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|-------|---------------------|------------------------------|------------------|------------------|-----------------|
| SGM4518 | SOIC-16 | -40℃ to +125℃ | SGM4518XS16G/TR | SGM4518XS16 XXXXX | Tape and Reel, 2500 |
| | SSOP-16 | -40℃ to +125℃ | SGM4518XQS16G/TR | SGM4518 XQS16 XXXXX | Tape and Reel, 4000 |
| | TSSOP-16 | -40℃ to +125℃ | SGM4518XTS16G/TR | SGM4518 XTS16 XXXXX | Tape and Reel, 4000 |
| | TQFN-3×3-16L | -40℃ to +125℃ | SGM4518XTQ16G/TR | 4518TQ XXXXX | Tape and Reel, 4000 |

## MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

**X X X X X**
- Vendor Code
- Trace Code
- Date Code - Year

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

Voltages Referenced to $V_{EE}$

$V_{CC}$ .................................................................... -0.3V to 40V
GND ..................................................................... -0.3V to 40V
Analog Switch I/O Voltage, $V_{IS}$ ..... ($V_{EE}$ - 0.3V) to ($V_{CC}$ + 0.3V)
Digital Control Voltage ............ (GND - 0.3V) to ($V_{CC}$ + 0.3V)
Continuous Current into Analog Switch I/O, X_ [1] or X ... ±40mA
Junction Temperature .................................................. +150℃
Storage Temperature Range ........................ -65℃ to +150℃
Lead Temperature (Soldering, 10s) ............................. +260℃
ESD Susceptibility
HBM ............................................................................ 4000V
CDM ............................................................................ 1000V

## RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range .................... -40℃ to +125℃

NOTE:
1. X_: Analog Switch Inputs X0-X7.

## OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. 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 even small parametric changes could cause the device not to meet the published specifications.

## DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

## PIN CONFIGURATIONS

**(TOP VIEW)**



**SOIC-16/SSOP-16/TSSOP-16**

**(TOP VIEW)**



**TQFN-3×3-16L**
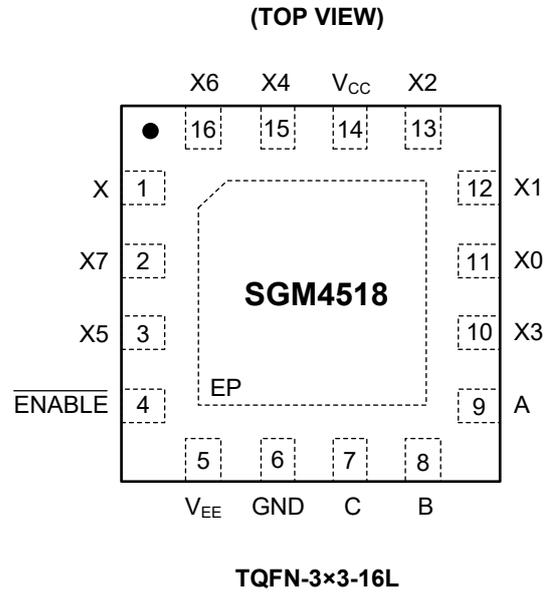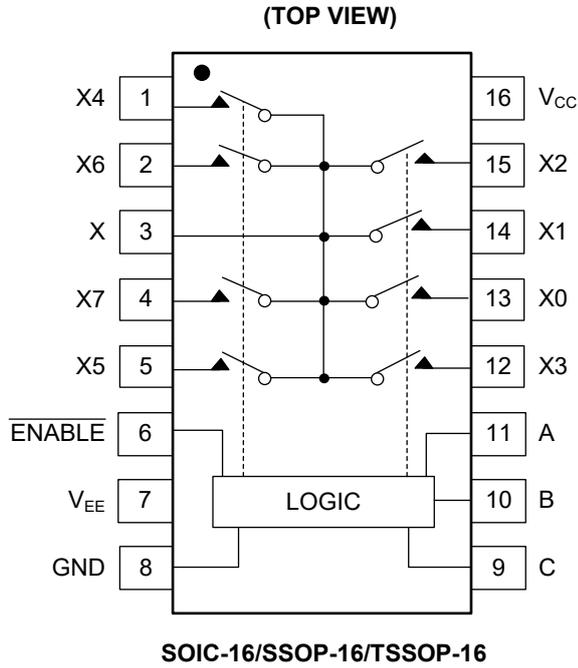
## PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|---|---|---|---|
| SOIC-16, SSOP-16, TSSOP-16 | TQFN-3×3-16L | | |
| 13, 14, 15, 12, 1, 5, 2, 4 | 11, 12, 13, 10, 15, 3, 16, 2 | X0-X7 | Analog Switch Inputs X0-X7. |
| 3 | 1 | X | Analog Switch "X" Output. |
| 16 | 14 | $V_{CC}$ | Positive Analog and Digital Supply Voltage Input. |
| 11 | 9 | A | Digital Address "A" Input. |
| 10 | 8 | B | Digital Address "B" Input. |
| 9 | 7 | C | Digital Address "C" Input. |
| 8 | 6 | GND | Ground. Connect to digital ground. (Analog signals have no ground reference; they are limited to $V_{CC}$ and $V_{EE}$.) |
| 7 | 5 | $V_{EE}$ | Negative Analog Supply Voltage Input. Connect to GND for single-supply operation. |
| 6 | 4 | $\overline{ENABLE}$ | Digital Enable Input (Active Low). |
| — | Exposed Pad | EP | Exposed Pad. It can be connected to $V_{EE}$ or be left floating. |

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

## FUNCTION TABLE

| $\overline{\text{ENABLE}}$ Input | Select Inputs | | | On Switches |
|---|---|---|---|---|
| | **C** | **B** | **A** | |
| H | *X* | *X* | *X* | All Switches Open |
| L | L | L | L | X-X0 |
| L | L | L | H | X-X1 |
| L | L | H | L | X-X2 |
| L | L | H | H | X-X3 |
| L | H | L | L | X-X4 |
| L | H | L | H | X-X5 |
| L | H | H | L | X-X6 |
| L | H | H | H | X-X7 |

*X* = Don't care.

# ELECTRICAL CHARACTERISTICS

($V_{CC}$ = 3.2V to 36V, $V_{EE}$ = 0V, GND = 0V, Full = -40℃ to +125℃, typical values are at $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **Analog Switch** | | | | | | | |
| Analog Signal Range | $V_{X\_}$, $V_X$ | | Full | $V_{EE}$ | | $V_{CC}$ | V |
| On-Resistance | $R_{ON}$ | $V_{CC}$ = 3.2V, $I_X$ = 10mA | +25℃ | | 26 | 34 | Ω |
| | | | Full | | | 44 | |
| | | $V_{CC}$ = 5V to 36V, $I_X$ = 10mA | +25℃ | | 22 | 29 | |
| | | | Full | | | 45 | |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_{CC}$ = 3.2V, $I_X$ = 10mA | +25℃ | | 0.1 | 4 | Ω |
| | | | Full | | | 5 | |
| | | $V_{CC}$ = 5V to 36V, $I_X$ = 10mA | +25℃ | | 0.2 | 3 | |
| | | | Full | | | 4 | |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_{CC}$ = 3.2V, $I_X$ = 10mA | +25℃ | | 8 | 14 | Ω |
| | | | Full | | | 18 | |
| | | $V_{CC}$ = 5V to 36V, $I_X$ = 10mA | +25℃ | | 11 | 17 | |
| | | | Full | | | 26 | |
| X_ Off Leakage Current | $I_{X\_(OFF)}$ | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_{X\_}$ = ±18V, $V_X$ = ∓18V | Full | | 0.01 | 2 | μA |
| X Off Leakage Current | $I_{X(OFF)}$ | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_{X\_}$ = ±18V, $V_X$ = ∓18V | Full | | 0.01 | 2 | μA |
| X On Leakage Current | $I_{X(ON)}$ | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_X$ = ±18V, $V_{X\_}$ = Floating | Full | | 0.01 | 1.5 | μA |
| **Digital I/O** | | | | | | | |
| Input High Voltage | $V_{AH}$, $V_{BH}$, $V_{CH}$, $V_{\overline{ENABLEH}}$ | | Full | 2.4 | | | V |
| Input Low Voltage | $V_{AL}$, $V_{BL}$, $V_{CL}$, $V_{\overline{ENABLEL}}$ | | Full | | | 0.8 | V |
| High-Level Input Current | $I_{AH}$, $I_{BH}$, $I_{CH}$, $I_{\overline{ENABLEH}}$ | $V_A$, $V_B$, $V_C$, $V_{\overline{ENABLE}}$ = $V_{CC}$ | +25℃ | | 0.3 | 1 | μA |
| | | | Full | | | 1.5 | |
| Low-Level Input Current | $I_{AL}$, $I_{BL}$, $I_{CL}$, $I_{\overline{ENABLEL}}$ | $V_A$, $V_B$, $V_C$, $V_{\overline{ENABLE}}$ = 0V | +25℃ | | 0.01 | 1 | μA |
| | | | Full | | | 1.5 | |
| **Dynamic Characteristics** | | | | | | | |
| Address Transition Time | $t_{TRANS}$ | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $V_{X\_}$ = 3V, 0V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 1 | +25℃ | | 150 | | ns |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_{X\_}$ = 3V, -3V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 1 | +25℃ | | 130 | | |
| $\overline{ENABLE}$ Turn-On Time | $t_{ON}$ | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $V_{X\_}$ = 3V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 2 | +25℃ | | 80 | | ns |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_{X\_}$ = 3V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 2 | +25℃ | | 70 | | |
| $\overline{ENABLE}$ Turn-Off Time | $t_{OFF}$ | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $V_{X\_}$ = 3V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 2 | +25℃ | | 160 | | ns |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_{X\_}$ = 3V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 2 | +25℃ | | 120 | | |
| Break-Before-Make Time | $t_D$ | $V_{CC}$ = 5V to 36V, $V_{X\_}$ = 3V, $C_L$ = 35pF, $R_L$ = 300Ω, Test Circuit 3 | +25℃ | | 70 | | ns |
| Charge Injection | Q | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $R_S$ = 0Ω, $C_L$ = 1nF, $V_S$ = 0V, Test Circuit 4 | +25℃ | | 90 | | pC |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $R_S$ = 0Ω, $C_L$ = 1nF, $V_S$ = 0V, Test Circuit 4 | +25℃ | | 160 | | |
| Off Isolation | $O_{ISO}$ | $V_{CC}$ = 5V to 36V, $R_L$ = 50Ω, f = 1MHz, Test Circuit 5 | +25℃ | | -85 | | dB |

## ELECTRICAL CHARACTERISTICS (continued)

($V_{CC}$ = 3.2V to 36V, $V_{EE}$ = 0V, GND = 0V, Full = -40℃ to +125℃, typical values are at $T_A$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| **Dynamic Characteristics (continued)** | | | | | | | |
| Input Off-Capacitance | $C_{X\_(OFF)}$ | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $V_{X\_}$ = 0V, f = 1MHz, Test Circuit 6 | +25℃ | | 20 | | pF |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_{X\_}$ = 0V, f = 1MHz, Test Circuit 6 | +25℃ | | 10 | | |
| Output Off-Capacitance | $C_{X(OFF)}$ | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $V_X$ = 0V, f = 1MHz, Test Circuit 6 | +25℃ | | 70 | | pF |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_X$ = 0V, f = 1MHz, Test Circuit 6 | +25℃ | | 25 | | |
| Output On-Capacitance | $C_{X(ON)}$ | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $V_X$ = 0V, f = 1MHz, Test Circuit 6 | +25℃ | | 70 | | pF |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $V_X$ = 0V, f = 1MHz, Test Circuit 6 | +25℃ | | 25 | | |
| -3dB Bandwidth | BW | $V_{CC}$ = 5V, $V_{EE}$ = 0V, $R_L$ = 50Ω | +25℃ | | 25 | | MHz |
| | | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $R_L$ = 50Ω | +25℃ | | 160 | | |
| Total Harmonic Distortion | THD | $V_{CC}$ = 18V, $V_{EE}$ = -18V, $R_L$ = 600Ω, $V_{OUT}$ = 5V$_{P-P}$, f = 1kHz | +25℃ | | 0.001 | | % |
| **Power Supply** | | | | | | | |
| Power Supply Range (Single Supply) | $V_{CC}$ | $V_{EE}$ = 0V | +25℃ | +3.2 | | +36 | V |
| Power Supply Range (Dual Supplies) | $V_{CC}$, $V_{EE}$ | | +25℃ | ±3.2 | | ±18 | |
| Power Supply Current | $I_{CC}$, $I_{EE}$ | $V_A$, $V_B$, $V_C$, $V_{\overline{ENABLE}}$ = $V_{CC}$ or 0V | +25℃ | | 15 | 24 | µA |
| | | | Full | | | 26 | |

# TYPICAL PERFORMANCE CHARACTERISTICS
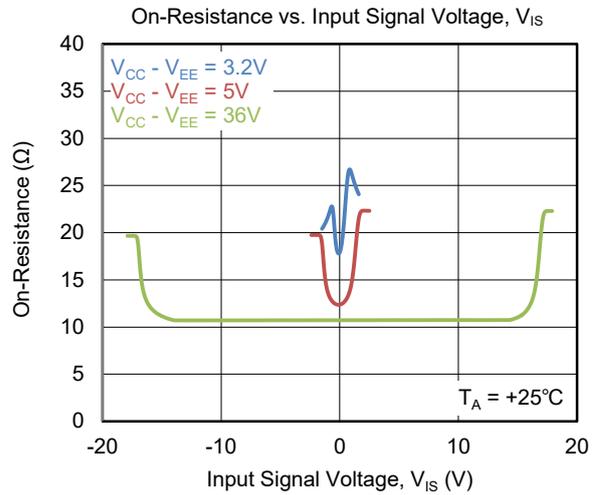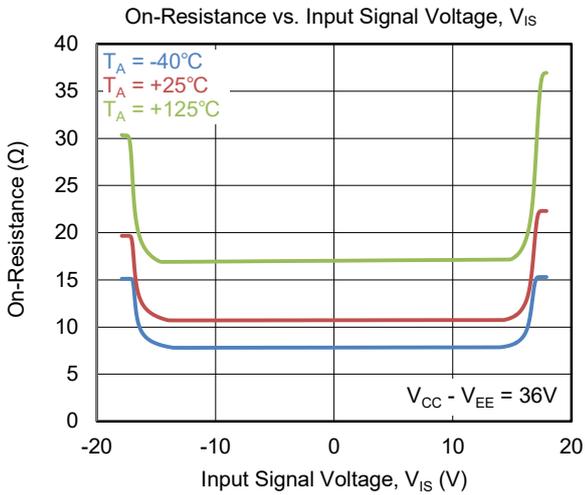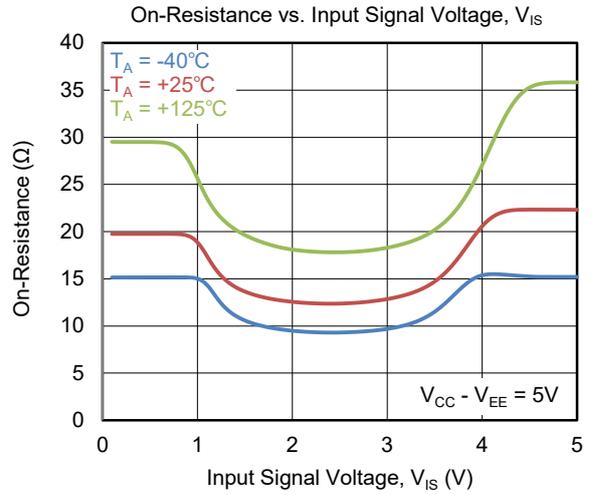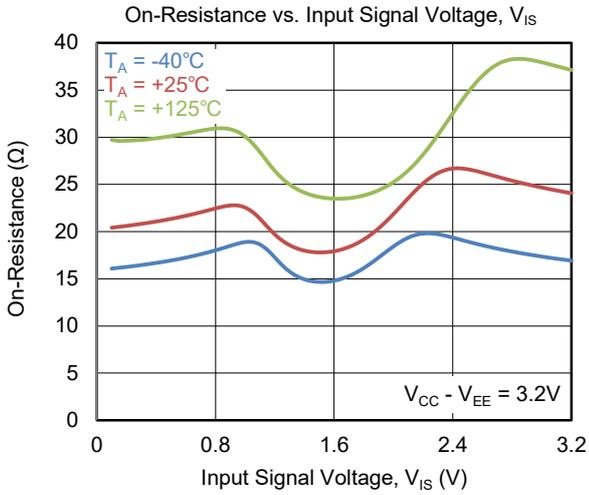
## TEST CIRCUITS
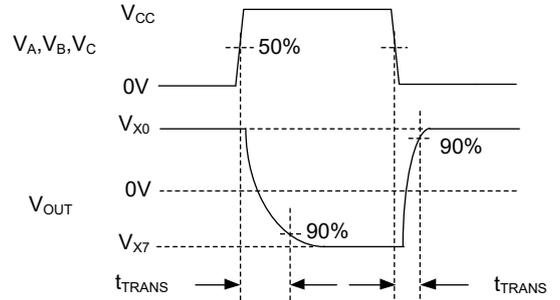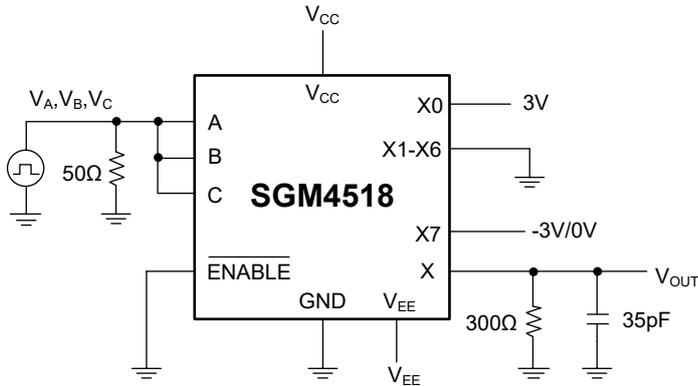
V_EE = 0V for Single-Supply Operation.
Test Each Section Individually.

**Test Circuit 1. Address Transition Times (t_TRANS)**
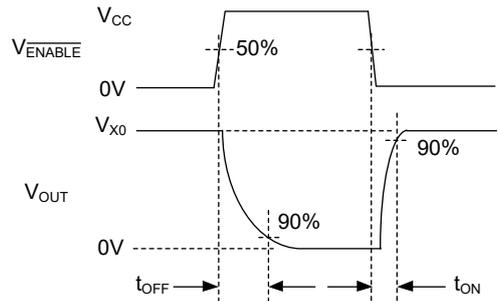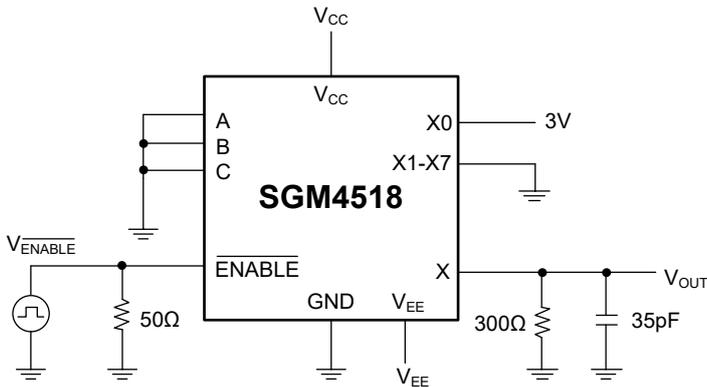
V_EE = 0V for Single-Supply Operation.
Test Each Section Individually.

**Test Circuit 2. Switching Times (t_ON, t_OFF)**
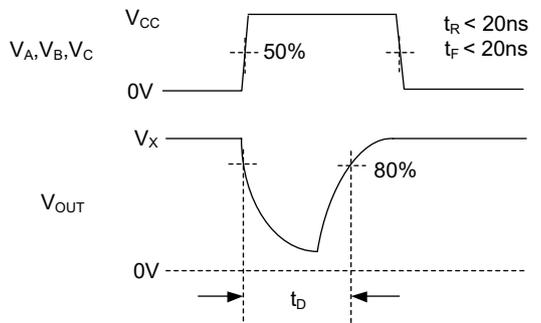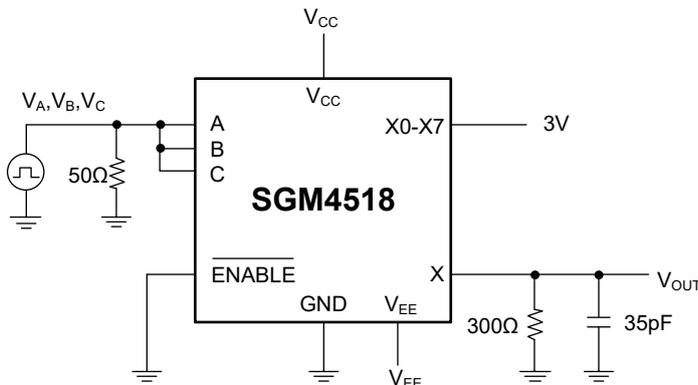
V_EE = 0V for Single-Supply Operation.
Test Each Section Individually.

**Test Circuit 3. Break-Before-Make Time (t_D)**

## TEST CIRCUITS (continued)
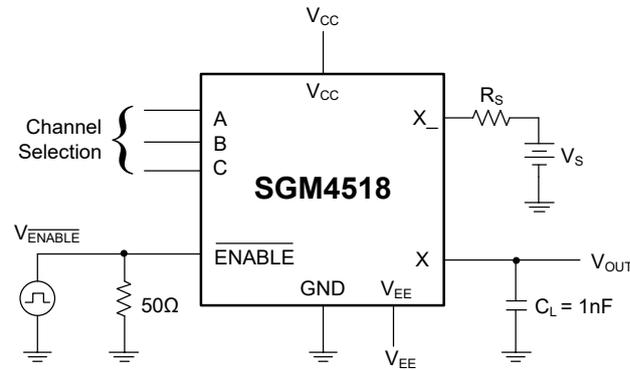


$V_{EE}$ = 0V for Single-Supply Operation.
Test Each Section Individually.
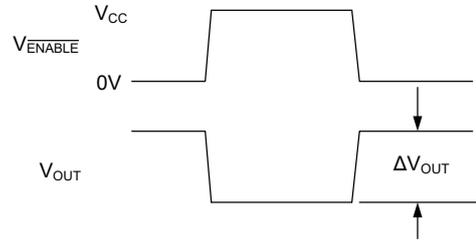
$\Delta V_{OUT}$ is the Measured Voltage due to Charge Transfer Error Q when the Channel Turns Off.
$Q = \Delta V_{OUT} \times C_L$

**Test Circuit 4. Charge Injection (Q)**
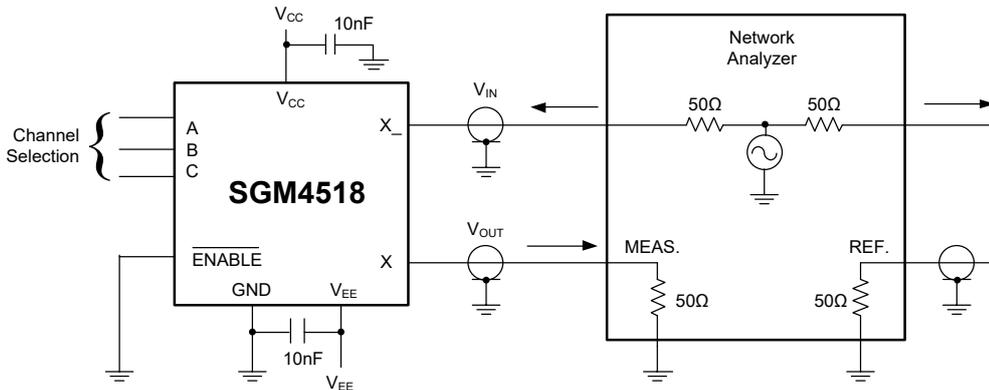


Off Isolation = $20\log (V_{OUT}/V_{IN})$

On Loss = $20\log (V_{OUT}/V_{IN})$

Measurements are Standardized against Short at Socket Terminals.
Off Isolation is Measured between X and "OFF" X_ Terminal on Each Switch.
On Loss is Measured between X and "ON" X_ Terminal on Each Switch.
Signal Direction through Switch is Reversed; Worst Values are Recorded.

**Test Circuit 5. Off Isolation, On Loss**
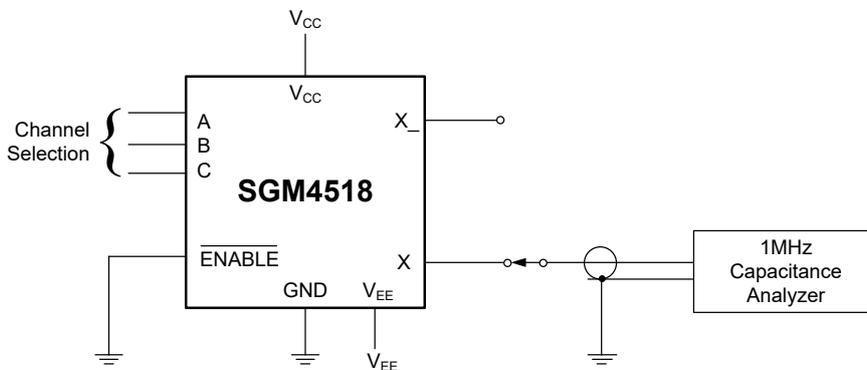


$V_{EE}$ = 0V for Single-Supply Operation.
Test Each Section Individually.

**Test Circuit 6. Capacitance**

# REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

**Changes from Original (DECEMBER 2020) to REV.A**                                                                                    **Page**

Changed from product preview to production data.................................................................................................................................All

## PACKAGE OUTLINE DIMENSIONS

## SOIC-16
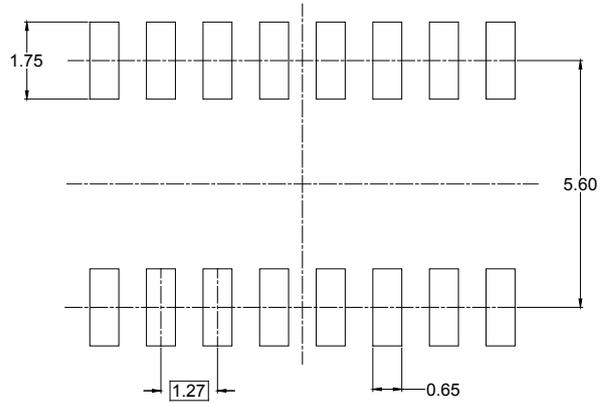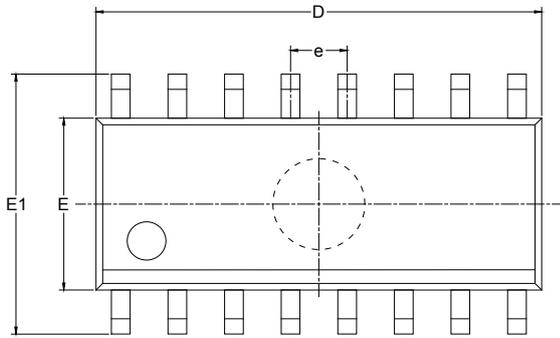
**RECOMMENDED LAND PATTERN** (Unit: mm)
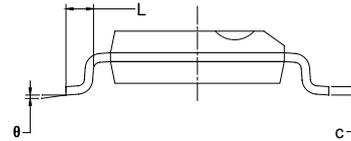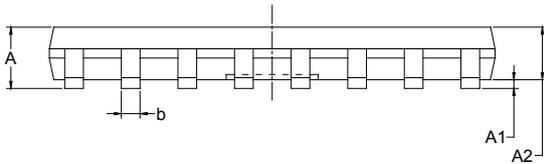
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------|------|------|------|
|        | MIN | MAX | MIN | MAX |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 9.800 | 10.200 | 0.386 | 0.402 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.27 BSC | | 0.050 BSC | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

TX00012.000

# PACKAGE OUTLINE DIMENSIONS

## SSOP-16
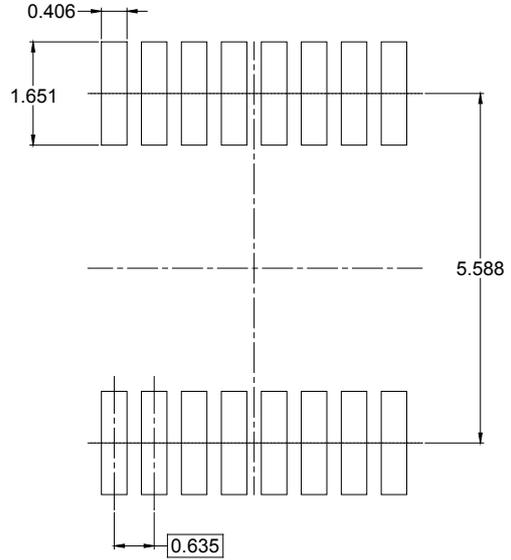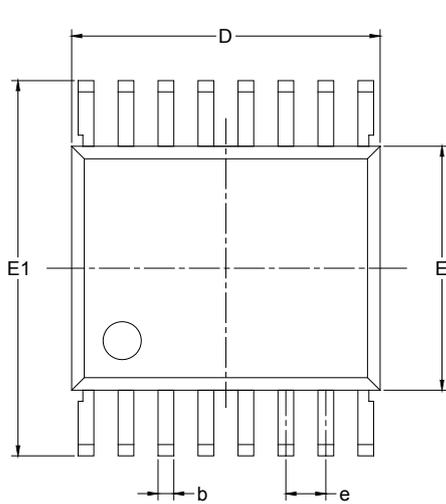


**RECOMMENDED LAND PATTERN** (Unit: mm)
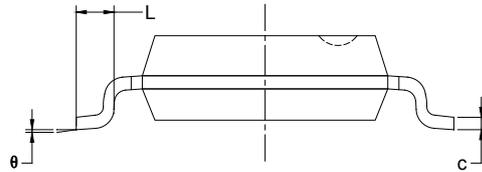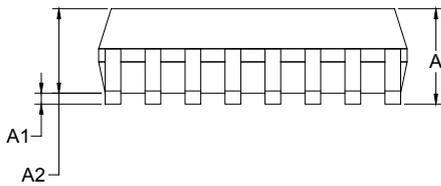


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------|------|------|------|
|        | MIN  | MAX  | MIN  | MAX  |
| A      | 1.350 | 1.750 | 0.053 | 0.069 |
| A1     | 0.100 | 0.250 | 0.004 | 0.010 |
| A2     | 1.350 | 1.550 | 0.053 | 0.061 |
| b      | 0.200 | 0.300 | 0.008 | 0.012 |
| c      | 0.170 | 0.250 | 0.007 | 0.010 |
| D      | 4.700 | 5.100 | 0.185 | 0.200 |
| E      | 3.800 | 4.000 | 0.150 | 0.157 |
| E1     | 5.800 | 6.200 | 0.228 | 0.244 |
| e      | 0.635 BSC | | 0.025 BSC | |
| L      | 0.400 | 1.270 | 0.016 | 0.050 |
| θ      | 0° | 8° | 0° | 8° |

TX00026.000

## PACKAGE OUTLINE DIMENSIONS

### TSSOP-16
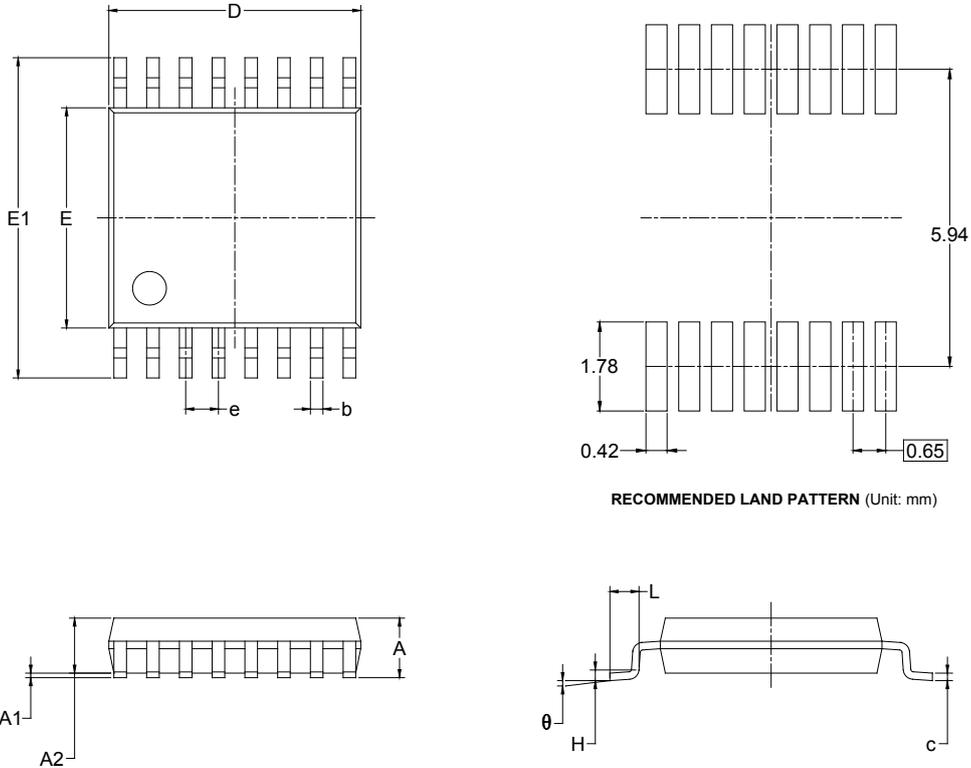
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | | 1.200 | | 0.047 |
| A1 | 0.050 | 0.150 | 0.002 | 0.006 |
| A2 | 0.800 | 1.050 | 0.031 | 0.041 |
| b | 0.190 | 0.300 | 0.007 | 0.012 |
| c | 0.090 | 0.200 | 0.004 | 0.008 |
| D | 4.860 | 5.100 | 0.191 | 0.201 |
| E | 4.300 | 4.500 | 0.169 | 0.177 |
| E1 | 6.200 | 6.600 | 0.244 | 0.260 |
| e | 0.650 BSC | | 0.026 BSC | |
| L | 0.500 | 0.700 | 0.02 | 0.028 |
| H | 0.25 TYP | | 0.01 TYP | |
| θ | 1° | 7° | 1° | 7° |

## PACKAGE OUTLINE DIMENSIONS

### TQFN-3×3-16L
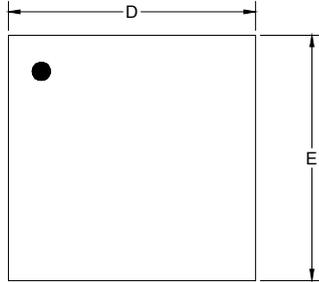
**TOP VIEW**
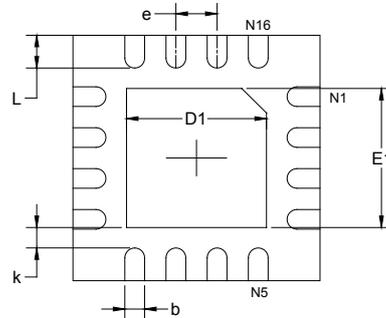
**BOTTOM VIEW**
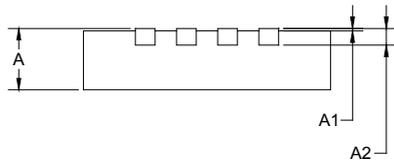
**SIDE VIEW**
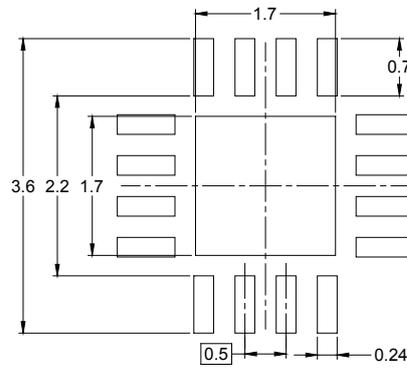
**RECOMMENDED LAND PATTERN** (Unit: mm)

| Symbol | Dimensions In Millimeters | | Dimensions 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
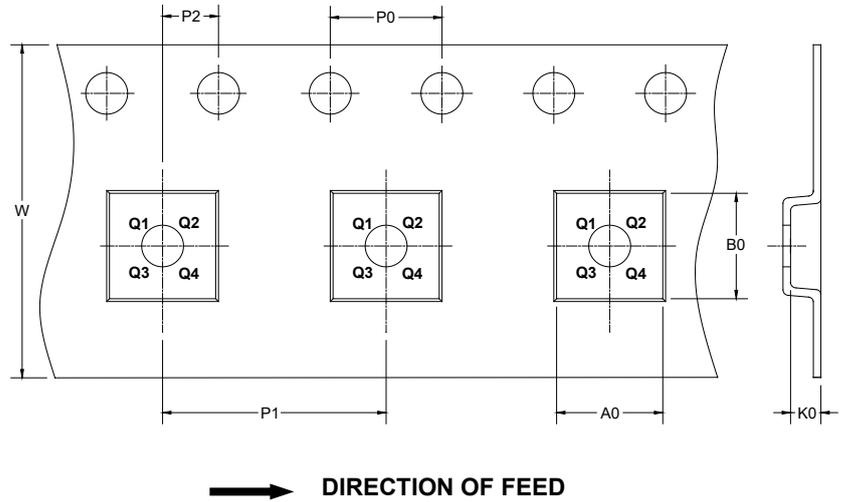
**DIRECTION OF FEED**

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 |
|---|---|---|---|---|---|---|---|---|---|---|
| SOIC-16 | 13″ | 16.4 | 6.50 | 10.30 | 2.10 | 4.0 | 8.0 | 2.0 | 16.0 | Q1 |
| SSOP-16 | 13″ | 12.4 | 6.40 | 5.40 | 2.10 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |
| 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 | Q2 |

DD0001

## CARTON BOX DIMENSIONS
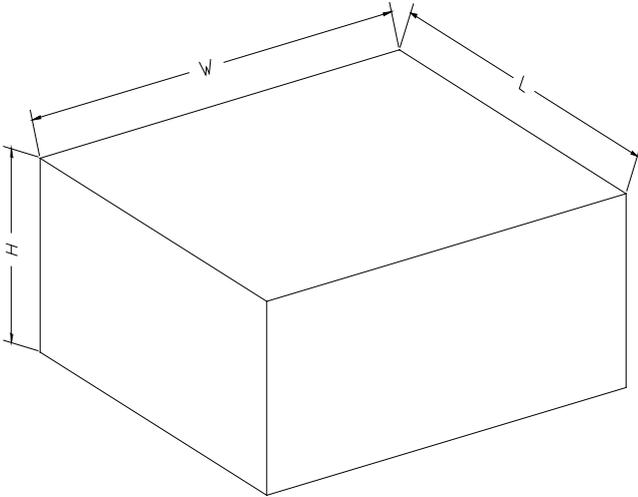
NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

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

DD0002