SGM4511/2
Quad SPST CMOS Analog Switches

GENERAL DESCRIPTION

The SGM4511 and SGM4512 are low cost, CMOS monolithic, quad single-pole single-throw (SPST) analog switches. These can be used in general purpose switching applications for telecommunications, instrumentation, process control, computer peripheral equipment and etc. An improved charge injection compensation design minimizes switching transients. The SGM4511 is a normally closed switch and the SGM4512 is a normally open switch.

The SGM4511 and SGM4512 can be continuously operated with power supplies ranging from ±4.5V to ±20V, and have an improved continuous current rating of 30mA. Both devices provide true bidirectional performance in the ON condition and will block signals to the supply levels in the OFF condition.

SGM4511 and SGM4512 are available in Green SOIC-16 and TSSOP-16 packages. They are specified -40℃ to +85℃ temperature range.

FEATURES

- **±20V Supply Voltage Rating**
- **1.8V Control Logic**
- **Low On-Resistance: 22Ω**
- **Single Supply Operation Possible**
- **Fast Switching Time**
  - **t_{ON} 40ns**
- **Low Charge Injection: 15pC**
- **Simple Logic Interface**
- **High Accuracy**
- **Minimum Transients**
- **Reduced Power Consumption**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green SOIC-16 and TSSOP-16 Packages**

APPLICATIONS

Industrial Instrumentation
Test Equipment
Communications Systems
Disk Drives
Computer Peripherals
Portable Instruments
Sample-and-Hold Circuits

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM4511	SOIC-16	-40℃ to +85℃	SGM4511YS16G/TR	SGM4511YS16 XXXXX	Tape and Reel, 2500
	TSSOP-16	-40℃ to +85℃	SGM4511YTS16G/TR	SGM4511 YTS16 XXXXX	Tape and Reel, 4000
SGM4512	SOIC-16	-40℃ to +85℃	SGM4512YS16G/TR	SGM4512YS16 XXXXX	Tape and Reel, 2500
	TSSOP-16	-40℃ to +85℃	SGM4512YTS16G/TR	SGM4512 YTS16 XXXXX	Tape and Reel, 4000

NOTE: **XXXXX** = Date Code and Vendor Code.

ABSOLUTE MAXIMUM RATINGS

Voltages Referenced V_{CC} to V_{EE} 44V
GND 25V
Digital Inputs (1), V_S, V_D
(V_{EE} - 0.3V) to (V_{CC} + 0.3V) or 30mA, whichever occurs first
Current (Any Terminal) 30mA
Peak Current, S or D
(Pulsed at 1ms, 10% Duty Cycle Max.) 100mA
Operating Temperature Range ..... -40℃ to +85℃
Junction Temperature ..... 150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... 260℃

NOTES:
1. Signals on SX, DX, or INX exceeding V_{CC} or V_{EE} will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

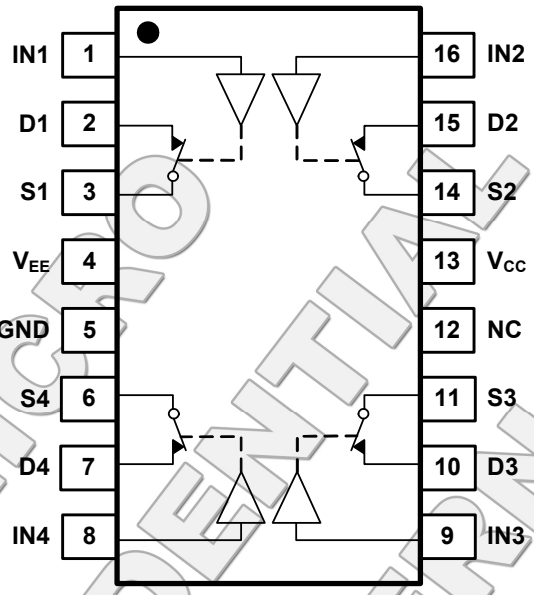
2. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATIONS (TOP VIEW)



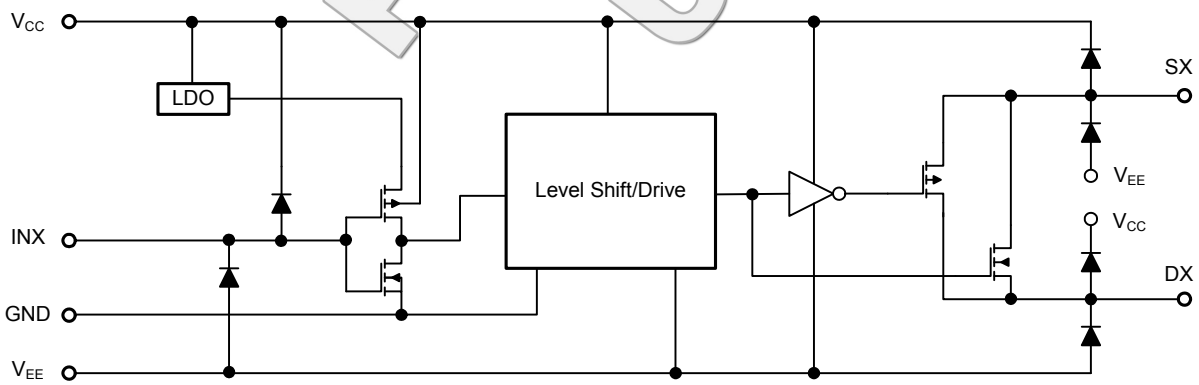
SOIC-16/TSSOP-16

FUNCTION TABLE

LOGIC	SGM4511	SGM4512
0	ON	OFF
1	OFF	ON

NOTES:
1. Logic "0" ≤ 0.2V.
2. Logic "1" ≥ 1.8V.

SCHEMATIC DIAGRAM



ELECTRICAL CHARACTERISTICS

(V_{CC} = 15V, V_{EE} = -15V, V_{INH} = 1.8V, V_{INL} = 0.2V. Typical values are at T_A = +25℃, Full = -40℃ to +85℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{ANALOG}		Full	-15		15	V
Drain-Source On-Resistance	$R_{DS(ON)}$	V_D = ±10V, I_S = 10mA	+25℃		22		Ω
On-Resistance Match	$\Delta R_{DS(ON)}$	V_D = ±10V, I_S = 10mA	+25℃		1		
Source Off Leakage Current	$I_{S(OFF)}$	V_S = ±10V, V_D = ±10V	+25℃		±0.1		μA
Drain Off Leakage Current	$I_{D(OFF)}$	V_D = ±10V, V_S = ±10V	+25℃		±0.1		
Drain On Leakage Current	$I_{D(ON)}$	V_S = V_D = ±10V	+25℃		±0.1		
DIGITAL CONTROL							
Input Voltage High	V_{INH}		+25℃	1.8			V
Input Voltage Low	V_{INL}		+25℃			0.2	
Input Current	I_{INH} or I_{INL}	V_{INH} or V_{INL}	+25℃		5		μA
Input Capacitance	C_{IN}		+25℃		11		pF
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_S = 10V, R_L = 1kΩ, C_L = 35pF, Test Circuit 1	+25℃		40		ns
Turn-Off Time	t_{OFF}		+25℃		120		
-3dB Bandwidth	BW	Signal = 0dBm, R_L = 50Ω, C_L = 5pF	+25℃		300		MHz
Off Isolation	O_{ISO}	C_L = 15pF, R_L = 50Ω, V_S = $1V_{RMS}$, f = 100kHz, Test Circuit 2	+25℃		-90		dB
Channel-to-Channel Crosstalk	X_{TALK}	C_L = 15pF, R_L = 50Ω, V_S = $1V_{RMS}$, f = 100kHz, Test Circuit 3	+25℃		-90		
Charge Injection	Q	C_L = 1000pF, V_G = 0V, R_G = 0Ω, Test Circuit 4	+25℃		15		pC
Source-Off Capacitance	$C_{S(OFF)}$	V_S = 0V, f = 1MHz	+25℃		7		pF
Drain-Off Capacitance	$C_{D(OFF)}$		+25℃		8		
Channel-On Capacitance	$C_{D(ON)}$	V_D = V_S = 0V, f = 1MHz	+25℃		12		
POWER SUPPLY							
Positive Supply Current	I_{CC}	V_{IN} = 0V or 5V	+25℃		400		μA
Negative Supply Current	I_{EE}		+25℃		-250		
Power Supply Range for Continuous Operation	V_{OP}		Full	±4.5		±20	V

ELECTRICAL CHARACTERISTICS

(V_{CC} = 12V, V_{EE} = 0V, V_{INH} = 1.8V, V_{INL} = 0.2V. Typical values are at T_A = +25℃, Full = -40℃ to +85℃, unless otherwise noted.)

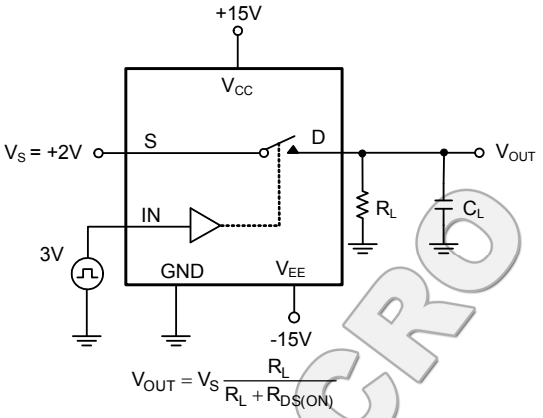
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{ANALOG}		Full	0		12	V
Drain-Source On-Resistance	$R_{DS(ON)}$	V_D = 3V or 8V, I_S = 10mA	+25℃		22		Ω
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	V_S = 8V, R_L = 1kΩ, C_L = 35pF, Test Circuit 1	+25℃		40		ns
Turn-Off Time	t_{OFF}		+25℃		200		
Charge Injection	Q	C_L = 1nF, V_G = 6V, R_G = 0Ω	+25℃		15		pC

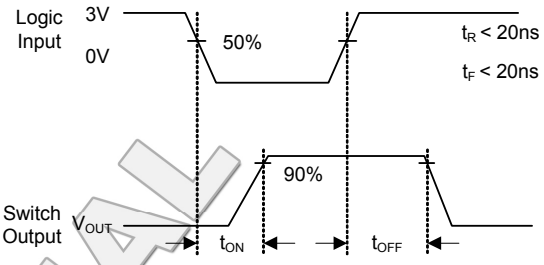
ELECTRICAL CHARACTERISTICS

(V_{CC} = 40V, V_{EE} = 0V, V_{INH} = 1.8V, V_{INL} = 0.2V. Typical values are at T_A = +25℃, Full = -40℃ to +85℃, unless otherwise noted.)

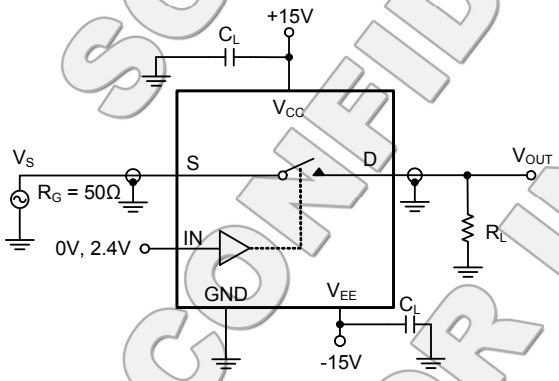
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{ANALOG}		Full	0		40	V
Drain-Source On-Resistance	$R_{DS(ON)}$	V_D = 20V, I_S = 10mA	+25℃		22		Ω
POWER SUPPLY							
Positive Supply Current	I_{CC}	V_{IN} = 0V or 5V	+25℃		600		μA
Negative Supply Current	I_{EE}		+25℃		-350		

TEST CIRCUITS

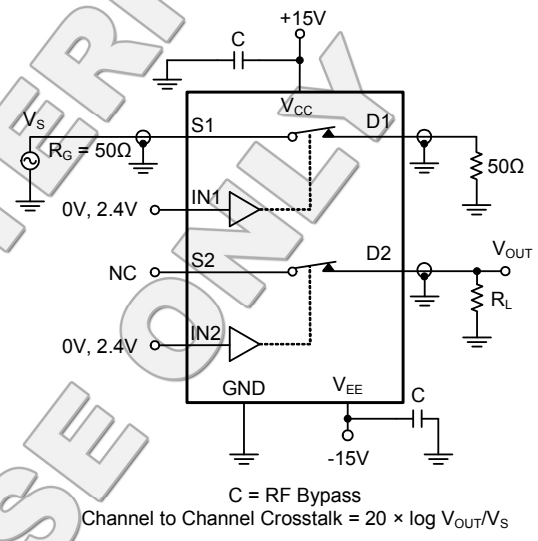




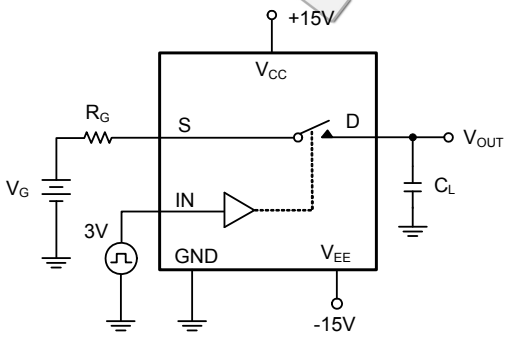
Test Circuit 1. Switching Times (t_{ON}, t_{OFF})

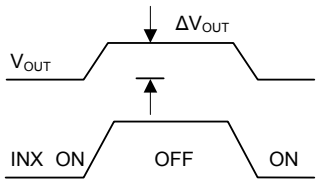


Test Circuit 2. Off Isolation



Test Circuit 3. Channel-to-Channel Crosstalk





ΔV_{OUT} = measured voltage error due to charge injection
The charge injection in coulombs is Q = C_L × ΔV_{OUT}

Test Circuit 4. Charge Injection

TYPICAL APPLICATIONS

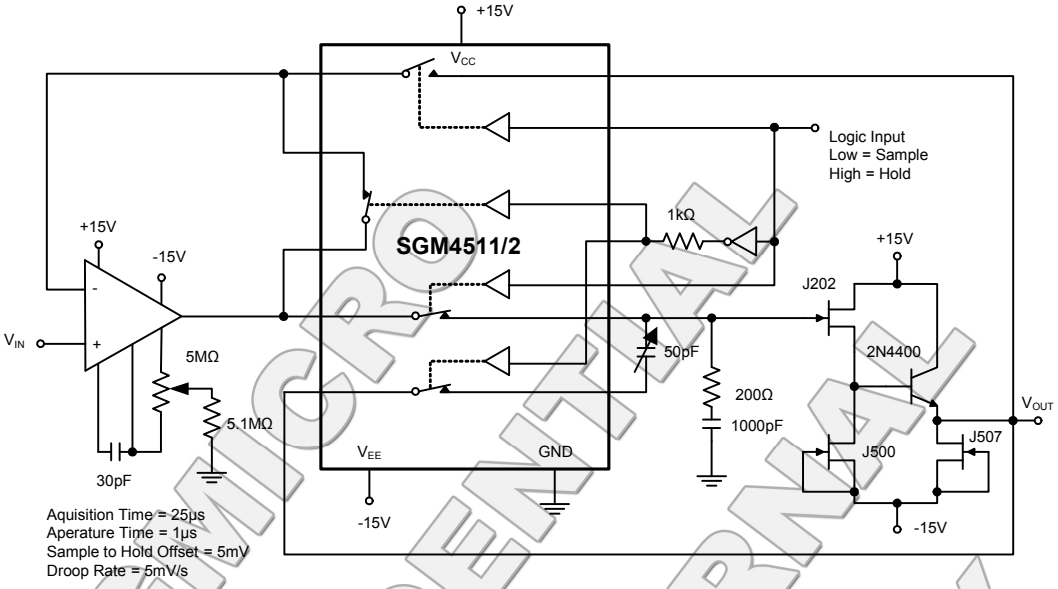
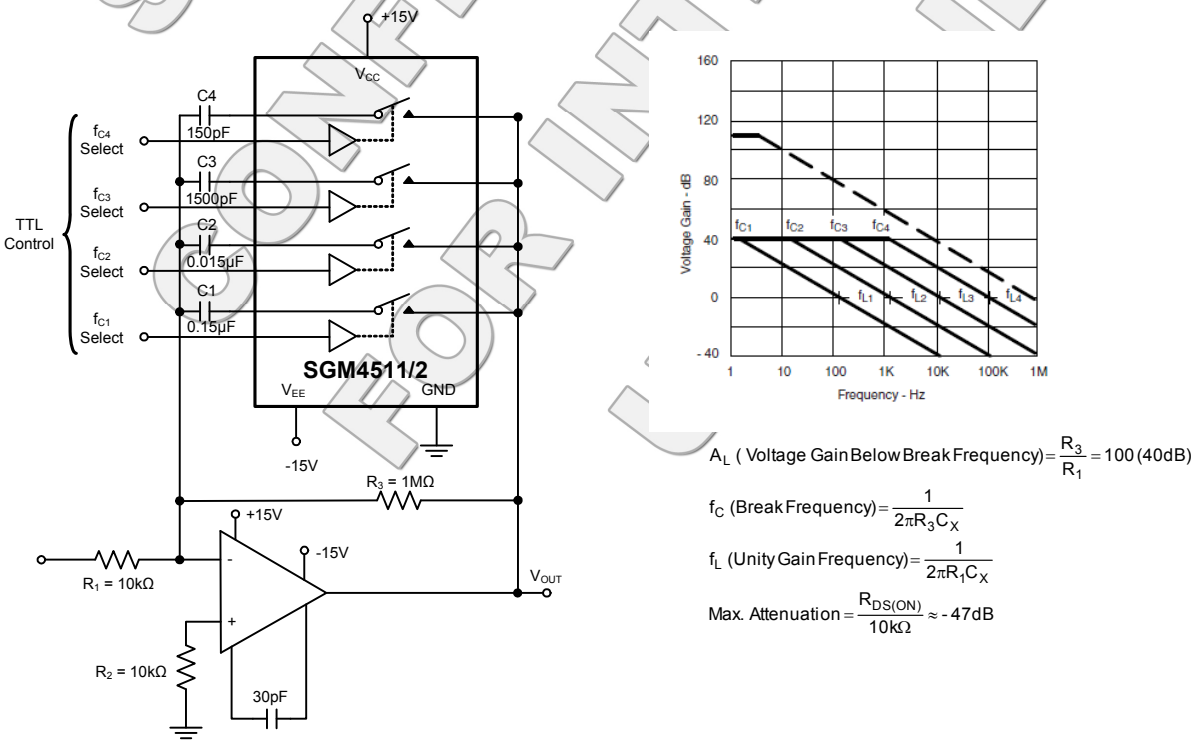


Figure 1. Sample-and-Hold



$$A_L \text{ (Voltage Gain Below Break Frequency)} = \frac{R_3}{R_1} = 100\,(40dB)$$

$$f_C \text{ (Break Frequency)} = \frac{1}{2\pi R_3 C_X}$$

$$f_L \text{ (Unity Gain Frequency)} = \frac{1}{2\pi R_1 C_X}$$

$$\text{Max. Attenuation} = \frac{R_{DS(ON)}}{10k\Omega} \approx -47dB$$

Figure 2. Active Low Pass Filter with Digitally Selected Break Frequency

TYPICAL APPLICATIONS

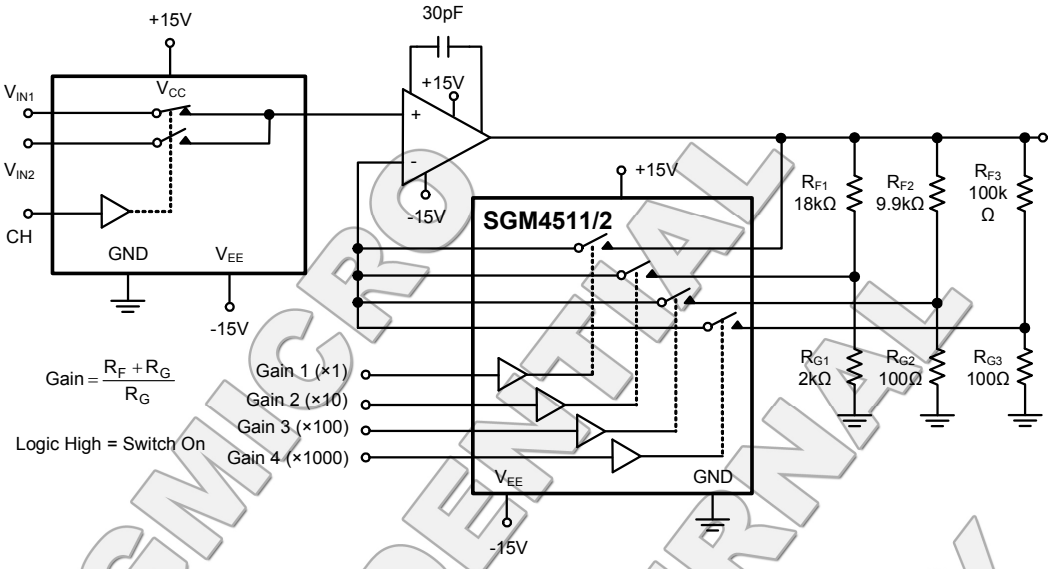
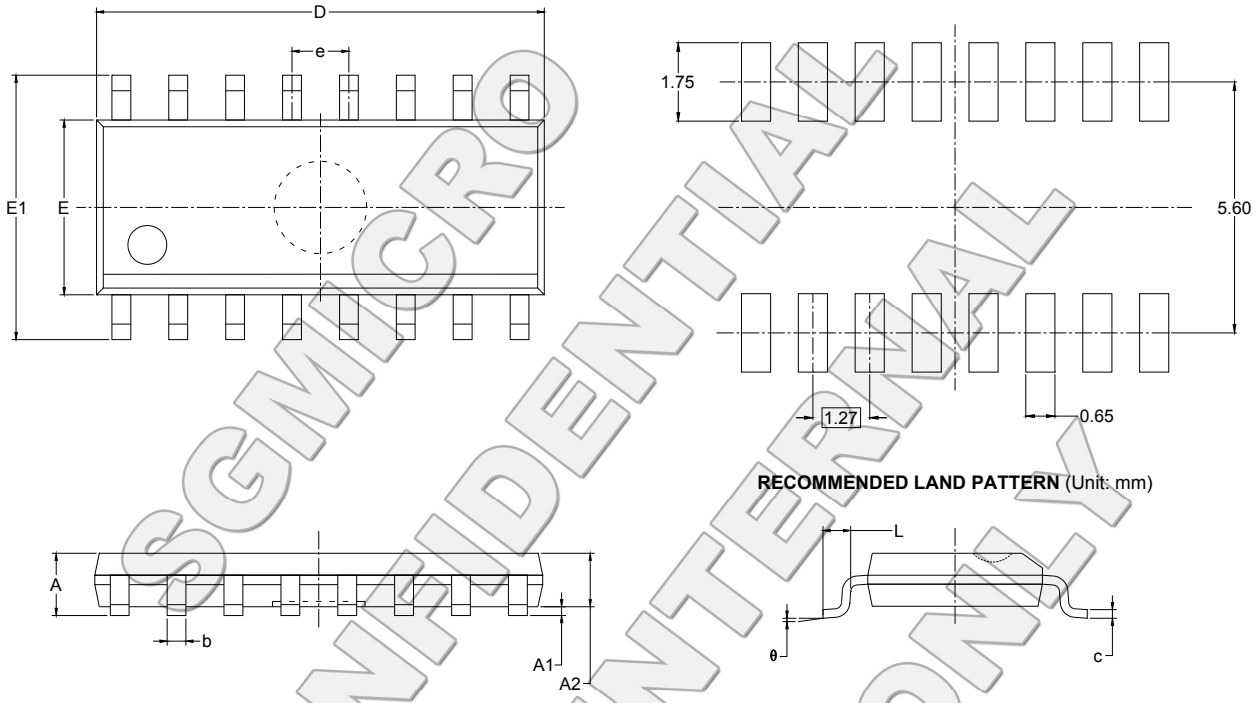


Figure 3. A Precision Amplifier with Digitally Programmable Input and Gains

PACKAGE OUTLINE DIMENSIONS

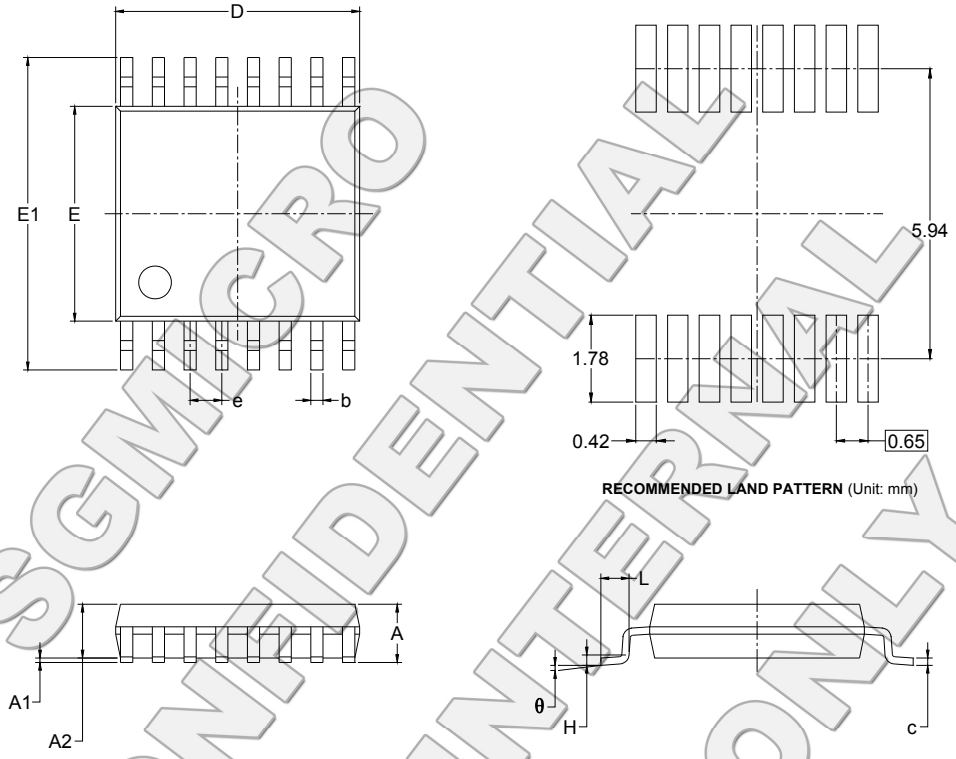
SOIC-16



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°

PACKAGE OUTLINE DIMENSIONS

TSSOP-16

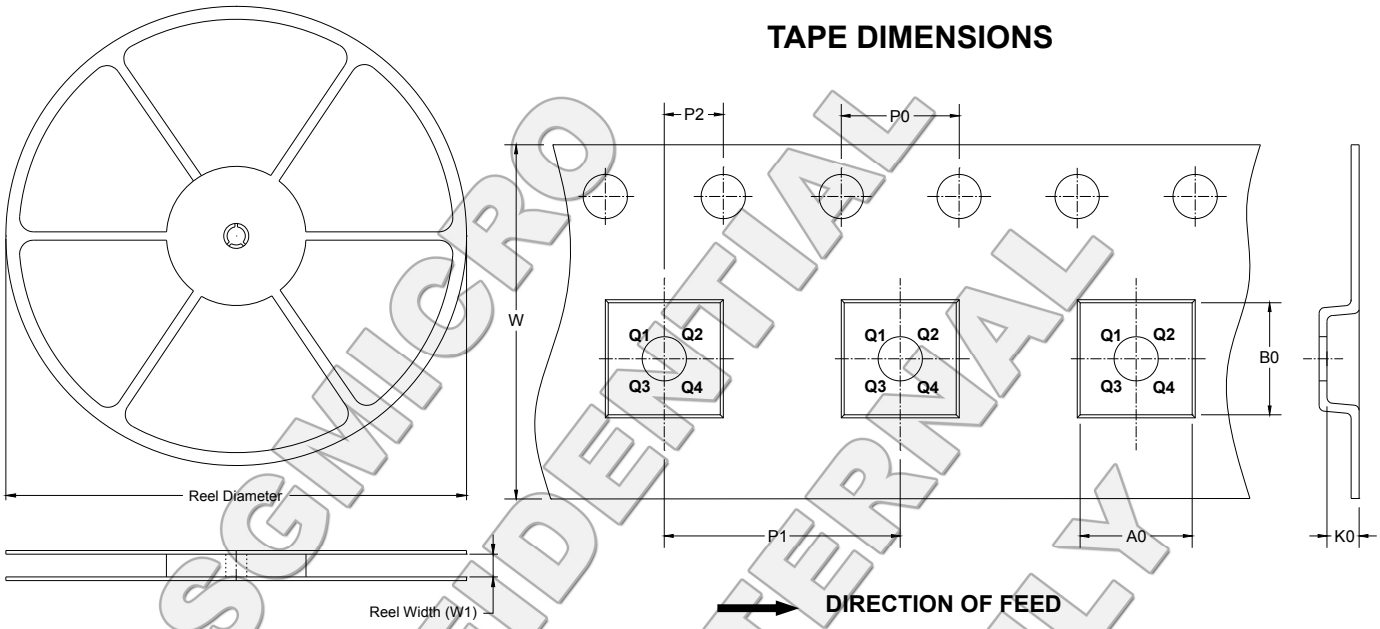


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500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

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

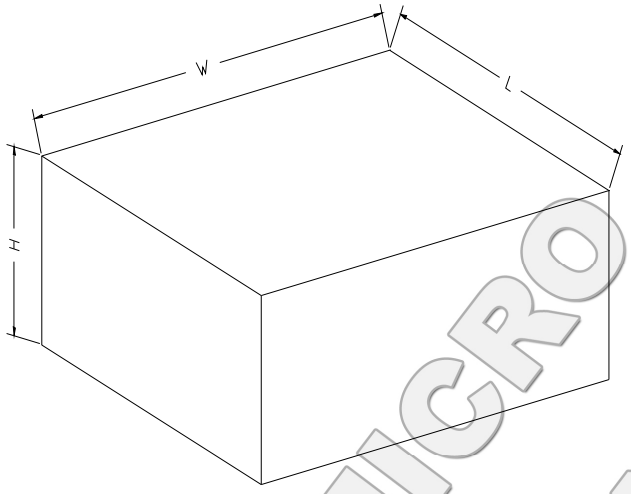


NOTE: The picture is only for reference. Please make the object as the standard.

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
SOIC-16	13″	16.4	6.5	10.3	2.1	4.0	8.0	2.0	16.0	Q1
TSSOP-16	13″	12.4	6.9	5.6	1.2	4.0	8.0	2.0	12.0	Q1

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