SGM4510
Quad SPST CMOS Analog Switch

GENERAL DESCRIPTION

The SGM4510 is a low cost, CMOS monolithic, quad single-pole/single-throw (SPST) analog switch. It 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 SGM4510 is a normally closed switch.

The SGM4510 can be continuously operated with power supplies ranging from ±4.5V to ±20V, and has an improved continuous current rating of 30mA. The device provides true bidirectional performance in the ON condition and blocks signals to the supply levels in the OFF condition.

The SGM4510 is available in a Green SOIC-16 package. It is specified over the -40℃ to +85℃ temperature range.

FEATURES

- **±4.5V to ±20V Dual Supply Operation**
- **4.5V to 40V Single Supply Operation**
- **1.8V Control Logic**
- **Low On-Resistance: 15.5Ω (TYP)**
- **Fast Switching Times:**
  - **t_{ON} = 120ns**
  - **t_{OFF} = 40ns**
- **Low Charge Injection: 55pC**
- **Simple Logic Interface**
- **Minimum Transients**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in a Green SOIC-16 Package**

APPLICATIONS

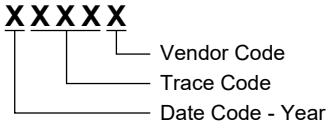
Industrial Instrumentation
Test Equipment
Communications Systems
Disk Drives
Computer Peripherals
Portable Instruments
Sample-and-Hold Circuits

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4510	SOIC-16	-40℃ to +85℃	SGM4510YS16G/TR	SGM4510YS16 XXXXX	Tape and Reel, 2500

MARKING INFORMATION

XXXXX = Date Code, Trace 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

Voltages Referenced to V_{EE}

V_{CC} 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_X or D_X

(Pulsed at 1ms, 10% Duty Cycle Max.) 100mA

Junction Temperature ..... +150℃

Storage Temperature Range ..... -65℃ to +150℃

Lead Temperature (Soldering, 10s) ..... +260℃

ESD Susceptibility

HBM 4000V

CDM 1000V

NOTE:

1. Signals on S_X, D_X, or IN_X exceeding V_{CC} or V_{EE} will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +85℃

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

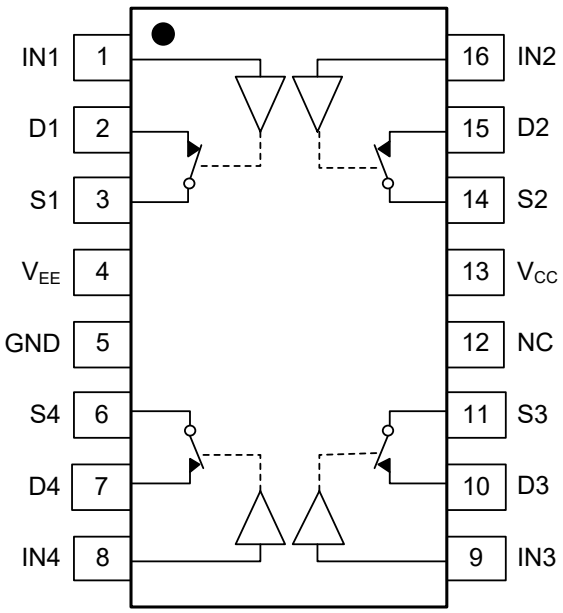
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

DISCLAIMER

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

PIN CONFIGURATION

(TOP VIEW)



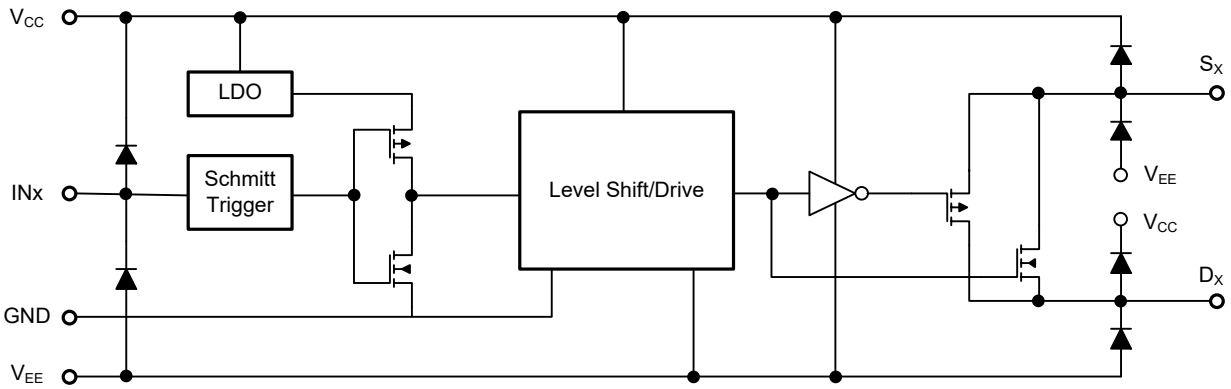
SOIC-16

FUNCTION TABLE

LOGIC	SGM4510
0	ON
1	OFF

NOTES:
1. Logic "0" ≤ 0.5V.
2. Logic "1" ≥ 1.6V.

SCHEMATIC DIAGRAM



ELECTRICAL CHARACTERISTICS

(V_{CC} = 15V, V_{EE} = -15V, GND = 0V, V_{INH} = 1.6V, V_{INL} = 0.5V, Full = -40℃ to +85℃. Typical values are at T_A = +25℃, 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℃		15.5	20	Ω
			Full			27	
On-Resistance Match Between Channels	$\Delta R_{DS(ON)}$	V_D = ±10V, I_S = 10mA	+25℃		0.15	0.7	Ω
			Full			0.8	
Source Off Leakage Current	$I_{S(OFF)}$	V_S = ±10V, V_D = ∓10V	+25℃		0.1	1	μA
Drain Off Leakage Current	$I_{D(OFF)}$	V_D = ±10V, V_S = ∓10V	+25℃		0.1	1	μA
Drain On Leakage Current	$I_{D(ON)}$	V_D = ±10V, V_S = ±10V or floating	+25℃		0.1	1	μA
Digital Control							
Input Voltage High	V_{INH}	V_{CC} = ±4.5V to ±20V	Full	1.6			V
Input Voltage Low	V_{INL}	V_{CC} = ±4.5V to ±20V	Full			0.5	V
Input Current	I_{INH}	V_{IN} = V_{INH}	+25℃		6.5	11	μA
			Full			12	
	I_{INL}	V_{IN} = V_{EE} or 0V	+25℃		0.1	1	
			Full			3	
Input Capacitance	C_{IN}	V_{IN} = 0V, f = 1MHz	+25℃		6		pF
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_S = 10V, R_L = 1kΩ, C_L = 35pF, Test Circuit 1	+25℃		120		ns
Turn-Off Time	t_{OFF}		+25℃		40		
-3dB Bandwidth	BW	R_L = 50Ω, C_L = 5pF, Signal = 0dBm	+25℃		300		MHz
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 15pF, Signal = 0dBm, f = 100kHz, Test Circuit 2	+25℃		-90		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 15pF, Signal = 0dBm, f = 100kHz, Test Circuit 3	+25℃		-110		dB
Charge Injection	Q	C_L = 1nF, V_G = 0V, R_G = 0Ω, Test Circuit 4	+25℃		55		pC
Source Off Capacitance	$C_{S(OFF)}$	V_S = 0V, f = 1MHz	+25℃		6		pF
Drain Off Capacitance	$C_{D(OFF)}$	V_D = 0V, f = 1MHz	+25℃		6		pF
Channel On Capacitance	$C_{D(ON)}$	V_D = 0V, f = 1MHz	+25℃		9		pF
Power Supply							
Positive Supply Current	I_{CC}	V_{CC} = 20V, V_{EE} = -20V, V_{IN} = V_{INH}	+25℃		210	310	μA
			Full			365	
Negative Supply Current	I_{EE}		+25℃	-125	-75		
			Full	-170			
Positive Supply Current	I_{CC}	V_{CC} = 20V, V_{EE} = -20V, V_{IN} = 0V	+25℃		365	520	
			Full			620	
Negative Supply Current	I_{EE}		+25℃	-330	-220		
			Full	-400			
Power Supply Range for Continuous Operation	V_{OP}		Full	±4.5		±20	V

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 12V, V_{EE} = 0V, GND = 0V, V_{INH} = 1.6V, V_{INL} = 0.5V, Full = -40℃ to +85℃. Typical values are at T_A = +25℃, 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 = 5V or 7V, I_S = 10mA	+25℃		15.5	20	Ω
			Full			27	
On-Resistance Match Between Channels	$\Delta R_{DS(ON)}$		+25℃		0.1	0.7	Ω
			Full			0.8	
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_S = 8V, R_L = 1kΩ, C_L = 35pF	+25℃		600		ns
Turn-Off Time	t_{OFF}		+25℃		40		
Charge Injection	Q	C_L = 1nF, V_G = 6V, R_G = 0Ω	+25℃		40		pC

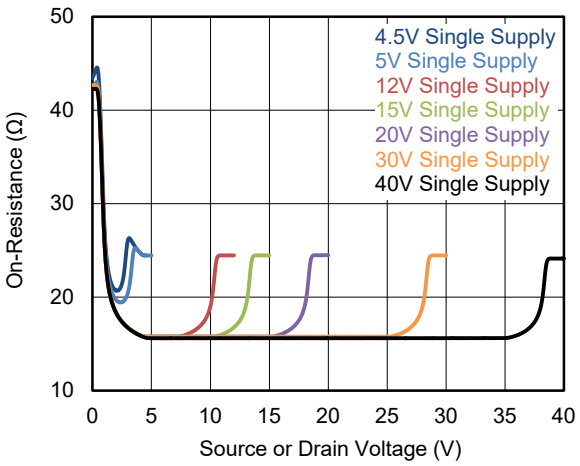
ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 40V, V_{EE} = 0V, GND = 0V, V_{INH} = 1.6V, V_{INL} = 0.5V, Full = -40℃ to +85℃. Typical values are at T_A = +25℃, unless otherwise noted.)

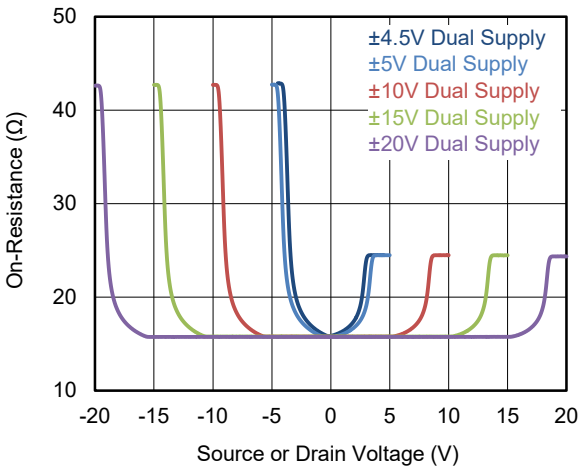
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Analog Switch							
Analog Signal Range	V_{ANALOG}		Full	0		40	V
Drain-Source On-Resistance	$R_{DS(ON)}$	V_D = 5V or 35V, I_S = 10mA	+25℃		15.5	20	Ω
			Full			27	
On-Resistance Match Between Channels	$\Delta R_{DS(ON)}$		+25℃		0.1	0.7	Ω
			Full			0.8	

TYPICAL PERFORMANCE CHARACTERISTICS

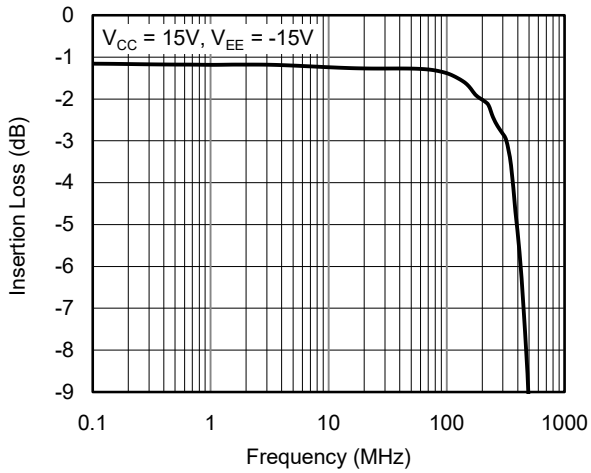
On-Resistance vs. Source or Drain Voltage



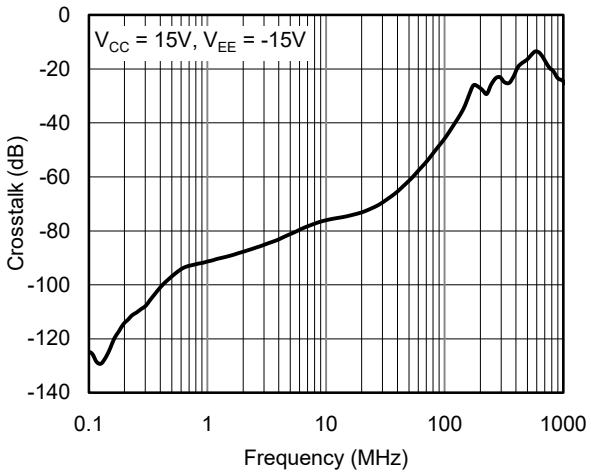
On-Resistance vs. Source or Drain Voltage



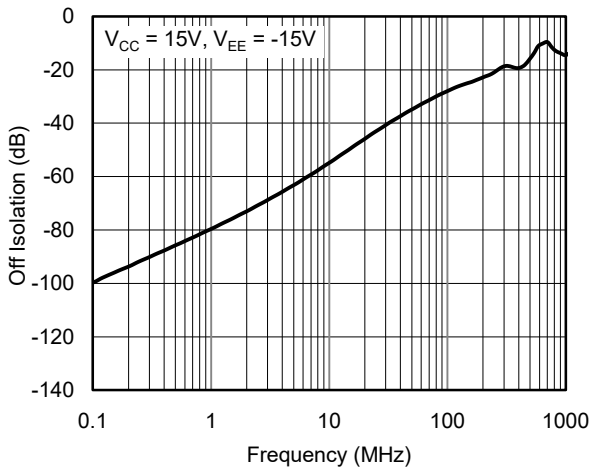
Insertion Loss vs. Frequency



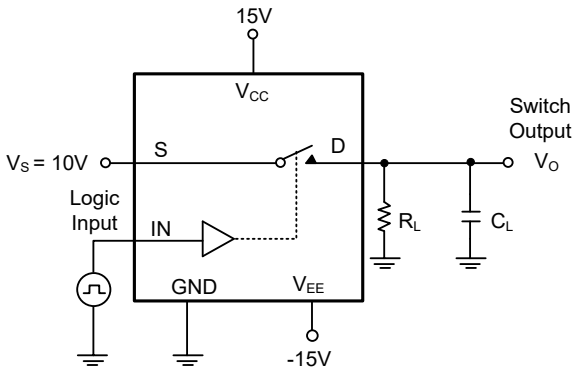
Crosstalk vs. Frequency

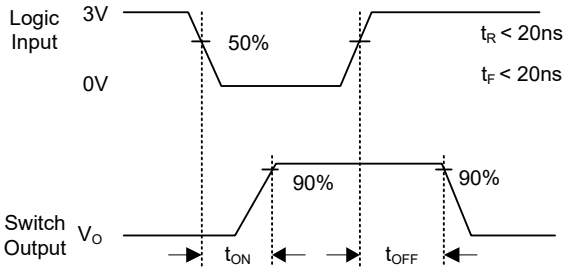


Off Isolation vs. Frequency



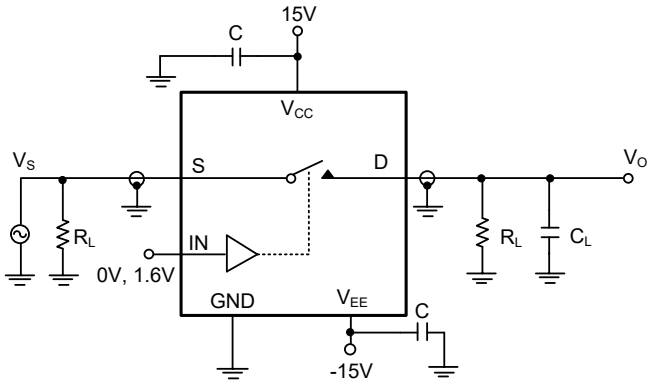
TEST CIRCUITS





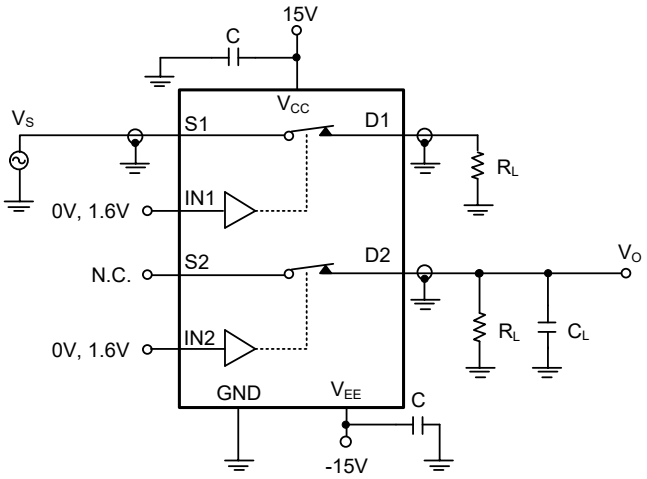
$$V_O = V_S \frac{R_L}{R_L + R_{DS(ON)}}$$

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



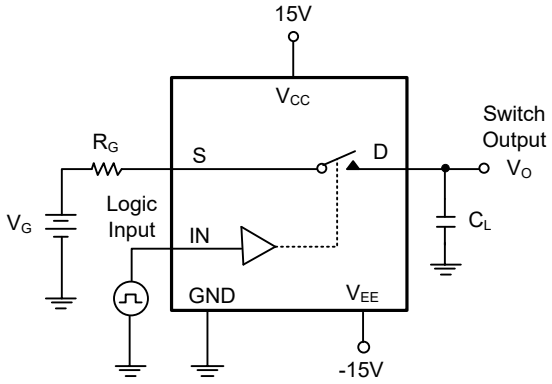
C = RF Bypass Capacitor
Off Isolation = 20 × log V_O/V_S

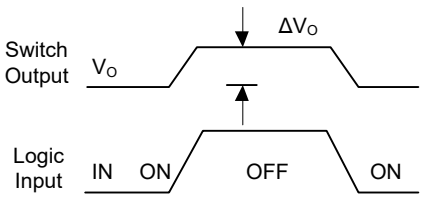
Test Circuit 2. Off Isolation



C = RF Bypass Capacitor
Channel-to-Channel Crosstalk = 20 × log V_O/V_S

Test Circuit 3. Channel-to-Channel Crosstalk





ΔV_O = measured voltage error due to charge injection .
The charge injection in coulombs is Q = C_L × ΔV_O.

Test Circuit 4. Charge Injection

TYPICAL APPLICATION CIRCUITS

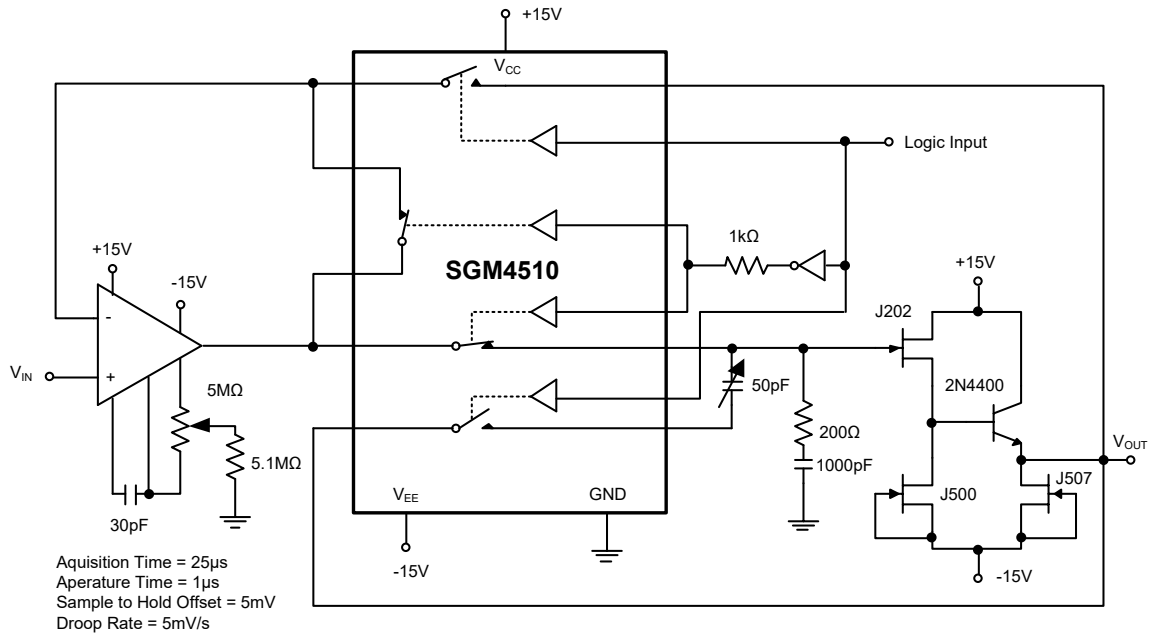
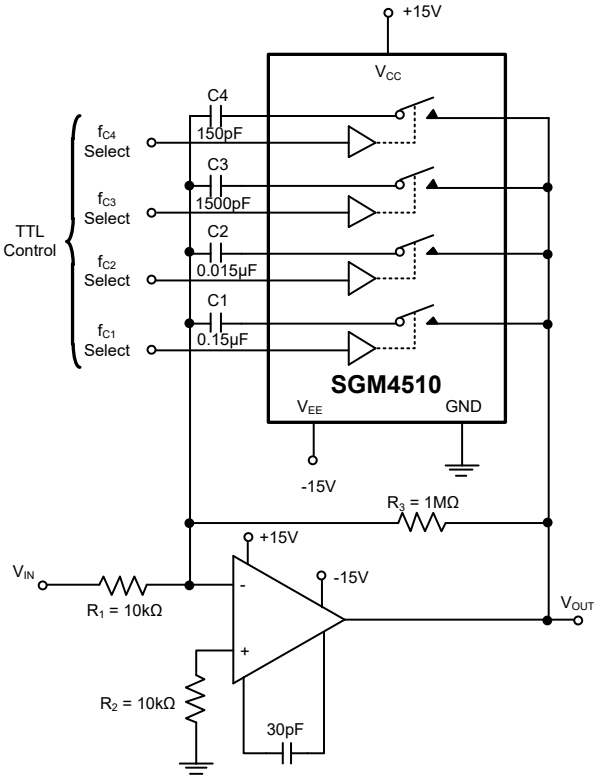
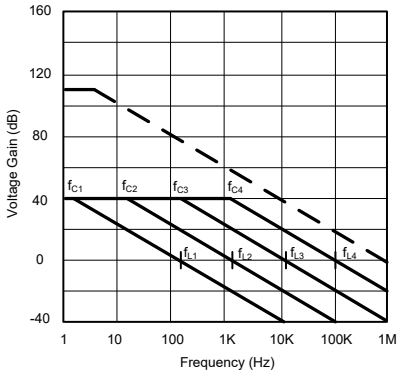


Figure 1. Sample-and-Hold





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

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

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

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

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

TYPICAL APPLICATION CIRCUITS (continued)

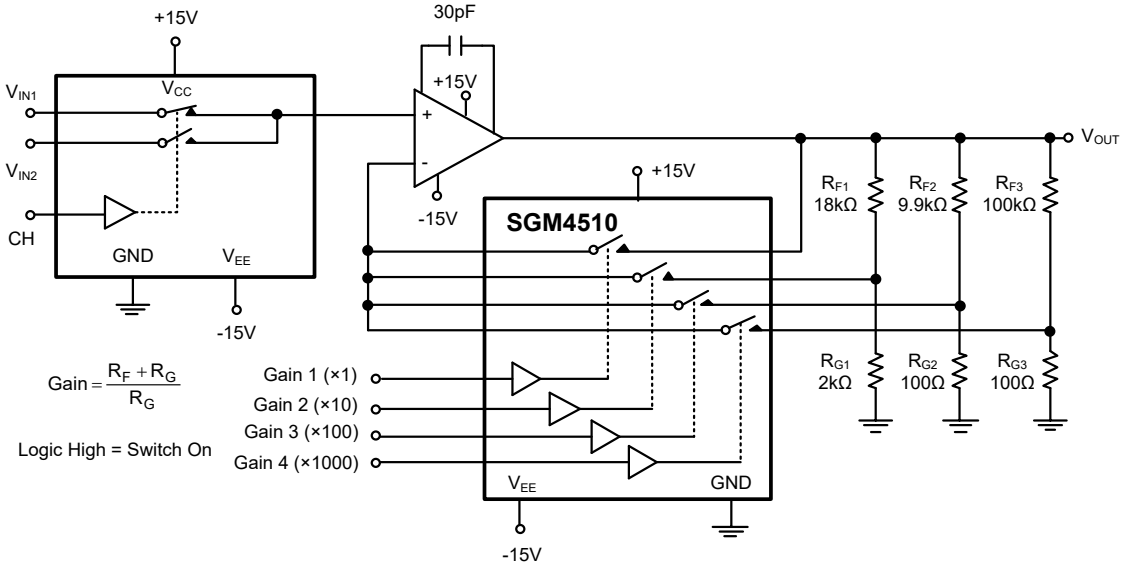


Figure 3. A Precision Amplifier with Digitally Programmable Input and Gains

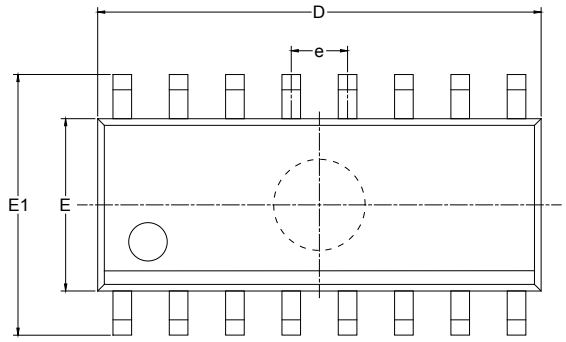
REVISION HISTORY

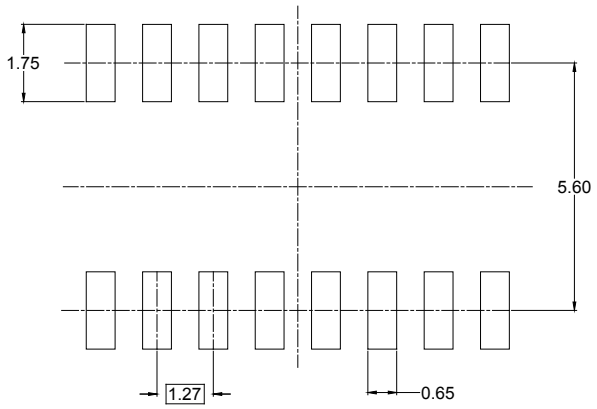
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (MAY 2019) to REV.A	Page
Changed from product preview to production data	All

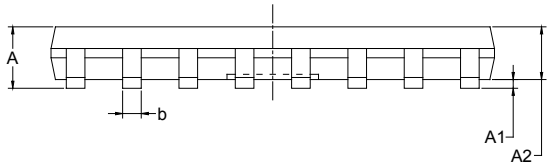
PACKAGE OUTLINE DIMENSIONS

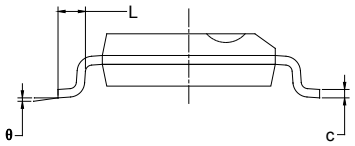
SOIC-16





RECOMMENDED LAND PATTERN (Unit: mm)

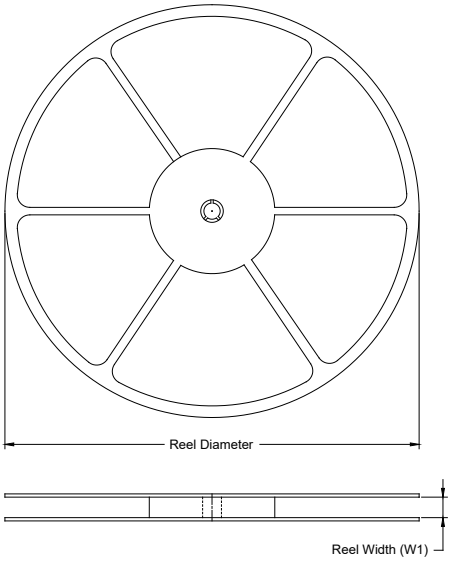




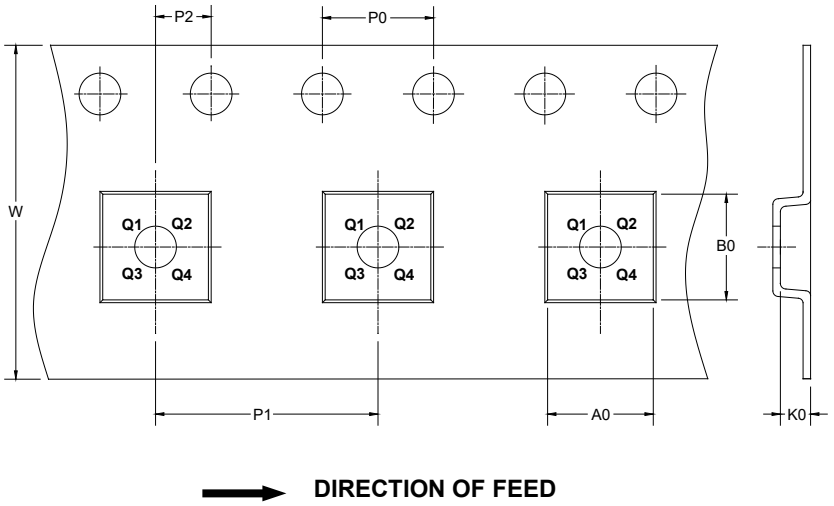
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



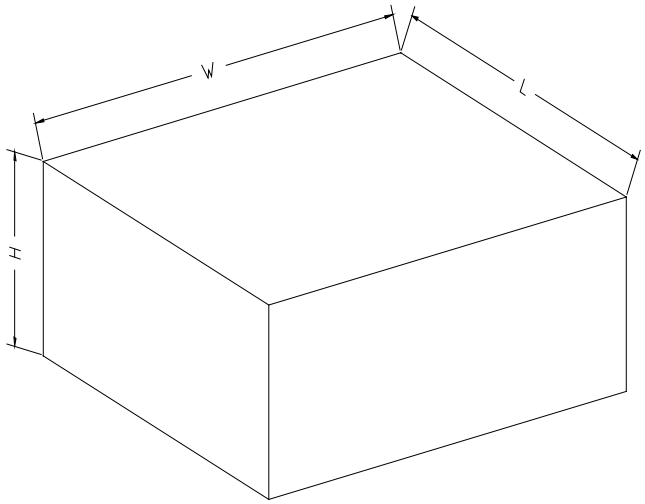
NOTE: The picture is only for reference. Please make the object as the standard.

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	6.50	10.30	2.10	4.0	8.0	2.0	16.0	Q1

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